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# SPECIFICATIONS

A TECHNICAL SERIES ON BUILDING CONSTRUCTION

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WALTER C. VOSS, *Editor*

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DWELLING HOUSE CONSTRUCTION—2nd Ed.

*By* ALBERT G. H. DIETZ

FIREPROOF CONSTRUCTION

*By* WALTER C. VOSS

MATERIALS OF CONSTRUCTION—Wood, Plastics, Fabrics

*By* ALBERT G. H. DIETZ

SPECIFICATIONS—2nd Ed.

*By* H. GRIFFITH EDWARDS

CONSTRUCTION MANAGEMENT AND SUPERINTENDENCE

*By* WALTER C. VOSS

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# SPECIFICATIONS

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H. GRIFFITH EDWARDS, A.I.A.

*School of Architecture*

*Georgia Institute of Technology*

*Member, Construction Specifications Institute, Inc.*



SECOND EDITION



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## Preface to the Second Edition

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Any textbook covering materials and methods of the construction industry is almost out of date the day it is printed due to the introduction of new products, grade rule changes, the formation of new associations, development of new standards and the like. Thus it is only natural that this book has been extensively revised for its Second Edition. For example, the development of latex and alkyd paints revolutionized paint manufacturing and the chapter on painting had to be completely rewritten.

Fortunately, the general aspects of specification writing remain relatively the same. Revisions to the first ten chapters include thoughts and improvements that have come to mind since the original text was written and the addition to Chapter 3 on Reference Material of many new associations of the construction industry and some of the new standards formed and developed since the first edition.

The new revised contract forms and other revised forms and documents of the American Institute of Architects have been added, and all of the chapters with trade titles have undergone considerable revisions to up-date them with current rules and practices. To the chapters on carpentry, the treatment of both framing and finish woodwork has been added, plus the requirements for termite control other than the use of termite shields.

Lathing and plastering used to be prevalent in residential construction but now drywall construction is more popular and more information on drywall construction has been added to the text.

This book now reflects the development of plastics in sheet form, as a flooring material and for caulking. Recognition is also made that many residences are now summer air-conditioned as well as having central heating systems for control of winter weather.

The original text included only those trade sections relative to a wood frame building, such as a residence, without consideration of the site development. Since most lending agencies will not furnish a mortgage unless the site is also developed, two new chapters have been added, one



entitled *Asphalt Paving* and the other one entitled *Lawns and Planting*.

It has been most gratifying that this book has been the accepted text for teaching specification writing in many universities and technical institutions and has been used by specification writers and architects in private practice. It is hoped by these revisions its usefulness will continue.

H. G. E.

## Preface to the First Edition

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Architects' specifications supplement with words the graphic representations of working drawings. The development of new equipment, materials and methods in building and the establishment of standards, grading rules and tests have created an increasingly important place for specifications. Most colleges of architecture have realized this and have added courses in specification writing to their curricula. Although there have been published several good master specifications intended to be copied in part and to serve as a guide for the experienced writer preparing specifications, there has been no adequate text for teaching the subject, no primer for the inexperienced architect.

This book is prepared primarily to fill this void. It cannot supply all the facts, but it deals with the assembling and arrangement of the facts to be found elsewhere by the student or specification writer. The good and bad points in the selection of words and phrases, the logic behind the grouping and arrangement of sentences, paragraphs and sections, and the methods involved in the assembling of the facts and their organization, are presented herein, along with enough technical information to illustrate the entire procedure of specification writing.

Part I, Chapters 1 through 10, deals with the general aspects of specification writing. Part II, Chapters 11 through 29, deals with the General Conditions and specific trades as related to specification writing for non-fireproof types of construction.

Specification writing is a broad field and to cover all its facets would require many volumes. For this reason, Part II of this book is limited in scope to the presentation of specifications for a simple, nonfireproof structure such as a residence. The fundamental principles presented, nonetheless, are applicable to larger jobs, fireproof and semifireproof construction, as well as to buildings of a specialized nature, such as hospitals and jails, where more detailed specifications are required.

Many of the specifications prepared by well-known architects and architectural firms all over the country still contain unnecessary verbiage and

many stilted, hackneyed and vague clauses and paragraphs, poorly arranged and poorly presented. It is hoped that this book, in addition to serving as a text, may also help to raise the standard and to eliminate the "dead wood" from these specifications.

This volume is intended as a primer in specification writing. The student or the architect must acquire for himself most of the construction data, the actual experience and technical knowledge necessary to produce good specifications.

H. G. E.

*January 15, 1953*  
*Atlanta, Georgia*

## Acknowledgments

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It is difficult to acknowledge the origin of all the material used in this book. The book is based in part upon notes accumulated years ago without any idea of incorporating them in a text, and the source is obscure. On the other hand, the known origins are too numerous to mention individually.

For many of the ideas and principles set forth in this book the author is indebted to the fine books and articles prepared by specification writing authorities including: James D. Beacham, Ben H. Dyer, Goldwin Goldsmith, Richard Shelton Kirby, Horace W. Peaslee, Harold Reeve Sleeper, and Ben John Small.

The author acknowledges having leaned heavily on *Handbook of Brick Masonry Construction* by John A. Mulligan while preparing Chapter 14; on *Selection of Lumber*, Farmers' Bulletin 1756, by the U. S. Department of Agriculture while preparing Chapters 17 and 18; on *Selection, Installation, Finish and Maintenance of Wood Floors for Dwellings*, Circular No. 489, by the U. S. Department of Agriculture while preparing Chapter 23; on *Paint Manual*, Report BMS105 by the U. S. Bureau of Standards while preparing Chapter 24; on *How to Design and Install Plumbing* by A. J. Matthias, Jr., while preparing Chapter 27; on *Reference Manual of Modern Gas Service* by the American Gas Association while preparing Chapter 28; and on *Home Wiring Handbook* by A. Carl Bredahl of the Westinghouse Electric Corporation while preparing Chapter 29.

For their many helpful suggestions the author wishes to thank Walter C. Voss, Robert L. Allen, Randolph E. Brown, and Terrell C. Wesley. The author is grateful for constructive criticism from William Stanley Parker in reviewing Chapters 10 and 11, from I. E. Morris in reviewing Chapter 13, from A. Arthur Kutsche in reviewing Chapter 20, from Robert S. Newcomb on Chapter 27, and from Charles F. Howe and A. Carl Bredahl who reviewed Chapter 29.

Liberal use has been made of manufacturers' catalogs and the publications of associations of manufacturers and professional groups, and of

government agencies. Particular credit is given under each table and illustration to the many agencies who so kindly allowed the use of their material.

The author feels the text is greatly improved by the illustrations prepared by Louis H. Swayze, Albert C. Brevetti, Frank S. Valenti, Sam H. McLean and, particularly, George A. Hampton, Jr. The author recognizes his indebtedness to June Johnson, Virginia George Atkinson and Frances Whitman for typing and retyping the manuscript and, last but not least, is grateful to his wife for advice, editing and proofreading.

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## PART I

### General Aspects of Specification Writing

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## CHAPTER 1

# Introduction to Specification Writing

---

### 1-1 MAIN DIVISIONS OF AN ARCHITECT'S WORK

- a. Although there are many ramifications to an Architect's activity, including the all-important phase of obtaining a client, an Architect's work consists of four major divisions:
  - 1. Preparation of preliminary drawings and presentations
  - 2. Preparation of working drawings and details
  - 3. Preparation of specifications
  - 4. Inspection of construction
- b. A well-informed Architect should have a good working knowledge of all four basic divisions; specification writing being one of these, it should not be neglected.

### 1-2 DEFINITION OF SPECIFICATIONS

- a. A good beginning in any subject is an attempt to define it in a few words. We may have a true concept in our minds of what the word *specification* means, and perhaps we could express this well in many words, but to choose a few is difficult. The dictionary states simply, "*Specification*—a designation or statement of particulars," but this does not fully define *construction specifications*.
- b. The following definition is imperfect, but it is a start toward formulating our concept:

*"Construction specifications are written instructions distinguishing or limiting and describing in detail construction work to be undertaken."*

- c. Construction specifications are produced for several purposes as follows:
  - 1. *Project Specifications* are those developed for a particular construction project to accompany the Working Drawings. After the contract

for the construction work is signed, these may be referred to as the Contract Specifications and the Contract Drawings.

2. *Guide Specifications* (sometimes referred to as Master Specifications) are example specifications prepared to be used as a guide in the preparation of Project Specifications. For a list of typical guide specifications, see Paragraphs 3-11 and 3-12.
3. *Standard Specifications* (sometimes referred to as Standards only) are specifications prepared to cover a specific material or a group of materials used by a specific trade, or a segment of the construction industry. Standards sometimes include methods of installation or application. Standard specifications are usually made a part of Project Specifications by reference. The most referred to standards are Standards of the American Society of Testing Materials and the Federal Specifications of the U. S. General Services Administration. Building, Plumbing, Heating and Electrical Codes are, in effect, standard specifications.
4. *Manufacturer's Specifications* are those published by manufacturers of building products or materials. Some of them are in the form of Guide Specifications, some in the form of Standard Specifications appearing in their catalogs, and some in the form of Installation Instructions shipped with the products or materials to the job site.
5. *Outline Specifications* are specifications prepared usually to accompany preliminary drawings presenting only the most basic information about materials and methods to be used and employed on a specific job.

### 1-3 PURPOSE OF SPECIFICATIONS

Specifications are generally written to supplement information shown on the architectural working drawings and they cover that portion of the work which is more easily expressed in words than by drawings. The purpose of project specifications is to serve as:

- a. *Guide to Bidders*, enabling their estimators to arrive at a fair price for the work involved;
- b. *Contract Document* between Owner and Contractor, limiting and describing their responsibilities;
- c. *Fabrication and Installation Guide* for materials and equipment.

### 1-4 FOR WHOM WRITTEN

Although project specifications are written upon order, so to speak, from the Owner, it is not for his use that they are prepared. Unless the Owner is technically minded, they will mean no more to him than a doctor's prescription with its pharmaceutical terms and symbols—he may not even

read them. Probably no one person except the specification writer himself will read all sections; but all sections of each set of specifications will certainly be read by many persons if the job is properly bid and constructed. Those for whom the specifications are written include the estimators, buyers, superintendents, and foremen of the Contractor and of his Subcontractors, the vendors (material salesmen) and the Architect's job inspector.

#### 1-5 BY WHOM WRITTEN

For small structures, project specifications may be prepared by the same individual making the working drawings and the one who will later supervise the work. In large architectural and engineering offices the specifications are often prepared by a specification expert who devotes his entire time to that one function, or by a special department composed of a group spending all its time writing specifications.

#### 1-6 SPECIFICATION WRITING

- a. Specification writing does not require as much imagination and originality as it does visualization, research, clear thinking and organization. A good specification writer should have an understanding of all the other phases of an Architect's work plus a thorough knowledge of materials and construction methods gained through study and actual experience. Then, while preparing specifications he should keep in mind several general rules:
- b. *Use Simple and Clear Language*, readily understood by the average layman. Be specific. Avoid the use of indefinite words or clauses. Attempt to prepare specifications that will require no interpretation as to meaning.
- c. *Be Brief*, and avoid long and involved sentences. Specifications tend to be too lengthy in spite of the greatest economy of words. Specify standard articles by reference to accepted standard specifications; this will eliminate many words.
- d. *Be Fair* and do not attempt to throw all risks and responsibility on the Contractor. Avoid the use of *weasel* clauses making the Contractor responsible for possible errors or omissions of the Architect, such as the following:

"The Contractor shall carefully read and note the work included in the specifications and shall include all other work that may be required to complete the building."
- e. *Include All Items Affecting the Cost of the Work* and describe in such detail as to leave no doubt as to the requirements. Warn the Contractor in the specifications of particular departures from standard practice likely to be encountered.

- f. *Avoid Repetition of Information* shown or scheduled on the drawings. Likewise avoid duplication within the specifications themselves. This will eliminate the possibility of contradiction.
- g. *Arrange Text Logically*: Follow an established pattern of grouping and sequence. Separate paragraphs into trade sections to facilitate the letting of subcontracts. For easy reference distinguish each paragraph with underlined word or words.
- h. *Do Not Include Inapplicable Text*: Avoid discussion of materials or methods which could not pertain to the actual construction work for which a set of specifications is prepared, as it is confusing to bidders. When old specifications are used for the preparation of the new set, the writer sometimes carelessly overlooks deleting inapplicable material.
- i. *Specify Stock Articles and Sizes* wherever possible. These are more easily obtained and are less expensive than special items or unusual dimensions.
- j. *Minimize Cross References* to sections and paragraphs of the specifications; when absolutely necessary, do so by referring to titles instead of numbers.
- k. *Do Not Specify the Impossible* or anything not intended to be enforced.

#### 1-7 SPECIFICATIONS AS A GUIDE TO BIDDERS

Prior to the awarding of a construction contract, plans and specifications are issued to a list of contractors. They are given several days or weeks (depending on the size of the job) to prepare bids. During this period the drawings and specifications serve as a guide to bidders. Much more accurate bids will be returned if the drawings and specifications are well coordinated, clear and specific.

#### 1-8 SPECIFICATIONS AS FABRICATION AND INSTALLATION GUIDE

Methods of fabrication and installation and finishes, gauges and quality cannot be shown graphically and must be explained in words. Therefore, the specifications are the form in which to give this information.

#### 1-9 SPECIFICATIONS AS A CONTRACT DOCUMENT

The contract documents are (1) the drawings and (2) specifications prepared for a job, (3) the Agreement between the Owner and Contractor and (4) the General Conditions of the Agreement. Many legal aspects of the contract are covered in the *General Conditions* section of the specifications.

#### 1-10 TYPES OF CONTRACTS

- a. Since the specifications will become a part of the contract documents, it is necessary to know the types of contracts usually drawn for con-

struction work. Of course, limitless types of contracts could be prepared, but those generally used for building purposes are:

- |                           |                          |
|---------------------------|--------------------------|
| 1. Lump Sum               | 3. Cost Plus a Fixed Fee |
| 2. Cost Plus a Percentage | 4. Unit Price            |
- b. These types of contracts are discussed in Chapter 10. The lump-sum contract has proved most practical for the small construction job and it is on this basis that most specifications are prepared.

#### 1-11 IMPORTANCE OF SPECIFICATIONS

In large architectural and engineering offices and in government agencies, it is often established by the contract documents that, in the event of a conflict within the drawings, the large scale details shall govern over small scale details, and that in the event of a conflict between the agreement and the specifications, the agreement shall govern. It is also established that in the event of a conflict between specifications and drawings, the specifications shall govern. This emphasizes the important part which the specifications play in construction work and the responsibility of the specification writer.

## CHAPTER 2

# Relation of Drawings and Specifications

---

### 2-1 SPECIFICATIONS AND DRAWINGS

- a. Specifications and drawings should be complementary. What is better described in the specifications should not be shown on the drawings, and likewise, what is better shown on the drawings should not be described in the specifications.
- b. *Items Better Shown on the Drawings* than described in the specifications are generally:
  - 1. Detail and overall dimensions
  - 2. Sizes of prefabricated items
  - 3. Location of materials, equipment, outlets and fixtures
  - 4. Location of finishes and openings
  - 5. Interrelation of materials and equipment
  - 6. Swing of doors
- c. *Items Better Described in the Specifications* than shown on the drawings are generally:
  - 1. Type of workmanship, materials, equipment and fixtures
  - 2. Quality of workmanship, materials, equipment and fixtures
  - 3. Finish of materials
  - 4. Gauges of materials
  - 5. Methods of fabrication and installation
  - 6. Allowances and unit costs
  - 7. General and special conditions; incidental work

### 2-2 NOTES ON DRAWINGS

- a. Hand lettering on drawings is expensive and therefore it is an economy to include instructions and descriptions in the specifications and not on the drawings. Notes on the drawings referring to materials should be general and not specific; in other words, the drawings should indicate the genus of a material and the specifications should describe the species. For example:

1. The drawings should indicate a material as "concrete" and the specifications should state whether it is to be 2,500 or 3,000 psi concrete, precast or cast-in-place concrete.
  2. The drawings should refer to "brick" and the specifications should cite whether it is to be face brick, common clay brick, concrete brick or the like.
  3. While the drawings should refer to the material "wood," the specifications should designate whether it is to be Southern Pine, White Pine, Ponderosa Pine or some other wood.
  4. The drawings should indicate "metal-flashing," whereas the specifications should stipulate whether it is galvanized sheet steel or copper and establish the gauge of the material.
  5. The drawings should refer to "shingles" and the specifications should state whether they are to be mineral-surface asphalt shingles, asbestos shingles or some other type.
- b. Many other examples could be given. If this rule is followed, the quality of materials affecting the cost of a job can be changed readily by alternates or addenda to the specifications without necessitating the trouble and expense of revising notes on the drawings and reprinting them. The possibility of conflict between specifications and drawings also will be minimized.

### 2-3 BRAND NAMES

- a. Even when brand names are to be specified, it is better not to use them on the drawings for the following reasons:
1. The brand listed on drawings may not be the brand eventually agreed upon, thus making the drawings at variance with other documents.
  2. More than one brand for each item should be allowed wherever possible, but this would be difficult to indicate on the drawings.
- b. Such words as *asbestos cement* should be used instead of *Transite*, *gypsum wallboard* rather than *Sheetrock*, *insulating glass* instead of *Thermopane*, *asphalt tile* for *Kentile*, etc.

### 2-4 FINISH SCHEDULES

In the past, architects attempted to describe the location of various interior finishes in the specifications and this became very complicated and confusing. It is now standard practice to list the interior finishes in schedule form on the drawings; the drawings thus determine the *location* of finishes, and the specifications give detailed *descriptions* of the finishes. See typical finish schedule as illustrated by Figure 2-1.



FINISH SCHEDULE							
SPACE	FLOOR	BASE	WAINSCOT	WALLS	CORNICE	CEILING	REMARKS
LIVING RM.	HARDWOOD	WOOD	NONE	PLASTER	WOOD	PLASTER	
DINING RM.	HARDWOOD	WOOD	W/CHAIR RAIL	PLASTER	WOOD	PLASTER	
LAUNDRY	ASPHALT TILE	NONE	NONE	EXP.BRICK	NONE	ASBESTOS BD.	
KITCHEN	LINOLEUM	WOOD	NONE	PLASTER	NONE	PLASTER	
BATH	TILE	TILE	TILE	KEENE'S CEM.	NONE	KEENE'S CEM.	WAINSCOT 4'-0" 6'-0" OVER TUB
BED RMS. 1,2	HARDWOOD	WOOD	NONE	PLASTER	WOOD	PLASTER	
CLOSETS 1,5	HARDWOOD	WOOD	NONE	WALL BD.	NONE	WALL BD.	5 SHELVES
GARAGE	CONCRETE	NONE	NONE	EXP.BRICK	NONE	CEMENT PL.	
CLOSETS 2,3,4	HARDWOOD	WOOD	NONE	WALL BD.	NONE	WALL BD.	2 SHELVES 1 ROD
CORRIDOR	HARDWOOD	WOOD	NONE	PLASTER	WOOD	PLASTER	

FIG. 2-1 TYPICAL FINISH SCHEDULE FOR SMALL JOB. In Finish Schedules for larger work involving many areas, finish numbers are listed in the first column, instead of space names, and the appropriate finish numbers are added to the areas shown on plans.

## 2-5 DOOR SCHEDULES

To describe the location of various types and sizes of doors in the specifications would also be complicated and confusing, and it has become standard practice to list the doors in schedule form on the drawings. A typical door schedule is shown by Figure 2-2.

## 2-6 WINDOW SCHEDULES

For certain types of work a window schedule on the drawings proves to be as much an advantage as the finish or door schedule, but generally, when stock windows are used and indicated on the elevations, it is not necessary to have a window schedule. In either case, the windows desired are fully described in the specifications.

## 2-7 CROSS-REFERENCE

Since the specifications and drawings are intended to supplement and complement each other, it is redundant to note on the drawings *see specifications*, or to use in the specifications the expression *as shown on the drawings*.

## 2-8 "EXCEPT WHERE OTHERWISE INDICATED ON DRAWINGS"

- a. When a particular type or size of article is used in the majority of a class of work it is an economy in drafting and good practice to omit the repetition of designating or dimensioning the article each time it occurs, except in those places where its type or size is a departure. The specifications will then describe the majority and the drawings will show the minority.

DOOR SCHEDULE								
DOOR NO.	SIZE			TYPE	MATERIAL	WOOD PANELS	GLASS	REMARKS
	WIDE	HIGH	THICK					
1	3'-0"	7'-0"	1 3/4"	"A"	WOOD	3 FLAT	NONE	RAISED MOLD
2, 5	3'-0"	7'-0"	1 3/4"	"B"	WOOD	2 FLAT	NONE	RAISED MOLD
3, 4, 6, 7	2'-8"	7'-0"	1 3/4"	"C"	WOOD	NONE	1 LT.	RAISED MOLD
8, 10, 11, 13	2'-6"	7'-0"	1 3/8"	"D"	WOOD	NONE	NONE	FLUSH
9, 15, 17	2'-8"	7'-0"	1 3/8"	"D"	WOOD	NONE	NONE	FLUSH
12, 14, 16	2'-8"	7'-0"	1 3/4"	"E"	WOOD	1 FLAT	1 LT.	
18	3'-0"	7'-0"	1 3/4"	"F"	WOOD	NONE	NONE	"V" GROOVED

DETAIL OF RAISED MOLD →

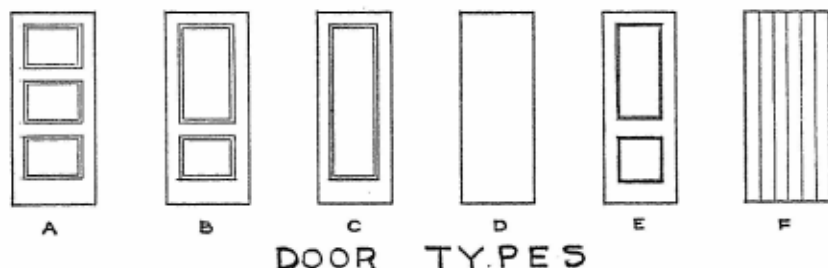


FIG. 2-2 TYPICAL DOOR SCHEDULE FOR SMALL JOB. Door Schedules for larger work have additional columns labeled *Threshold, Lintel, Transom, Label, Closer, Cylinder Locks* and the like.

- b. For example: residential drawings generally have partitions of unusual size in 2 places; a 6" nominal rough dimension of partition where plumbing pipes occur and a 2" nominal rough dimension where studs may be turned sideways for partitions between closets. The dimensions of these exceptions should be noted on the drawings and the specification sentence describing walls and partitions should cover the majority and read:

"Walls and partitions, except where otherwise indicated on drawings, shall be of 2 x 4's spaced 16" o.c."

- c. Another example: if the drawings show the size and bearing of lintels over exceptionally large openings in 4" masonry veneer and there are many other smaller openings without lintel indications, the specification paragraph could read:

"Openings in 4" masonry veneer, except where otherwise indicated on the drawings, shall have 3½" x 3½" x ¼" steel angle lintels with 4" bearing at each end."

- d. The phrase "*unless otherwise indicated on drawings*" reveals the specification writer has not studied the drawings sufficiently to know whether or not an article has been otherwise indicated. This phrase should not be used in place of "*except where otherwise indicated on drawings*."

## 2-9 ARRANGEMENT OF DRAWINGS AND SPECIFICATIONS

- a. Just as the specifications should be arranged logically, the working drawings for a construction job are also grouped and arranged in logical order dictated by custom. This is generally as follows:
1. Plot plan
  2. Building plans, starting with foundation or basement plan and ending with roof plan
  3. Elevations, usually beginning with the front or main elevation
  4. Sections, longitudinal and transverse
  5. Schedules, finish, door and window
  6. Details, architectural
  7. Structural drawings
  8. Mechanical drawings such as plumbing, heating, air conditioning and electrical.
- b. The specification writer must familiarize himself thoroughly with all of these drawings. The most logical arrangement for specifications follows as nearly as possible *chronological sequence of construction*. This is discussed at length in Chapter 4.

## CHAPTER 3

# Reference Material

---

### 3-1 GENERAL

The job of writing architectural specifications requires research and organization of many facts. Knowledge and experience are more important than imagination or originality (often emphasized in other phases of architecture). Since no one man could possibly have had enough experience or know all of the facts about construction methods and materials, it is necessary to refer to many sources for the information necessary to prepare specifications intelligently. Knowing where to go for reference becomes very important. This chapter deals with useful reference material available to specification writers.

### 3-2 SOURCES OF INFORMATION

Reference sources for the specification writer include the printed codes and ordinances of cities or other municipalities, the standards prepared by testing societies and government agencies, the grade rules, standards and model specifications prepared by manufacturers' associations and professional societies, individual manufacturer's catalogs, master specifications and previously written specifications. In addition, there is the information acquired by personal observation and contact with trained or experienced men in the construction industry.

### 3-3 CODES AND ORDINANCES

- a. Most large cities have building, plumbing and electrical codes or ordinances; these have been developed to protect the health, life and property of the community with emphasis on fire prevention and sanitation. Valuable information is contained in these local codes, and it is the law that all construction work shall comply with them. Not only should the specification writer study these documents, but he should make them a part of his specifications by reference, including the instruction that all work shall be performed in full accordance with local codes and ordi-

nances. Where no local codes or ordinances govern, reference should be made to the following national codes:

- b. *Building Code of the National Board of Fire Underwriters*, 85 John Street, New York, N. Y.
- c. *National Plumbing Code*, American Standards Association ASA No. A40.8.
- d. *National Electrical Code*, Standard of the National Board of Fire Underwriters for Electric Wiring and Apparatus as recommended by the National Fire Protection Association.

### 3-4 ORIGIN OF STANDARDS

- a. Before the improvement of manufacturing methods and transportation, buildings were primarily constructed of local materials, many of which were fabricated on the site. With the development of manufacturing processes and the wider markets offered by improved transportation, the number of manufacturers increased and they made an increasing variety of products. Lack of uniformity and a competitive market brought about a public need for standardization and grading. The government set up departments for testing materials and establishing standards. The manufacturers of similar products formed associations to establish minimum standards and grades for their articles, to ensure some uniformity in the market, and to encourage the use of their products by advertising. In addition a society was formed in 1898 known as the American Society for Testing Materials, consisting of companies, associations and individuals, whose purpose has been the promotion of knowledge of engineering materials and the standardization of specifications and the methods of testing.
- b. These associations, institutes and societies and governmental departments publish their findings in the form of standards, specifications, methods of testing and grade rules.

### 3-5 MATERIAL STANDARDS (Figures 3-1 and 3-2)

- a. It is excellent practice in specification writing to refer to material standards to "tie down" certain materials. This eliminates many words without sacrificing quality requirements and it opens the opportunity of furnishing the materials to all qualified manufacturers. The material standards generally referred to are the following:
  1. *ASTM Standards* issued by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. These may be purchased in single copies, in special compilations covering a particular field of materials or in a set of bound volumes known as the Book of ASTM Standards. (See Figure 3-2.) There is also a special paper-backed

printing entitled *ASTM Standards in Building Codes* (List Price \$8.00; Price to Members \$6.40) including only those standards related to buildings; every architect's office should have a copy.

2. *Federal Specifications* (abbreviated Fed. Spec.) prepared under the direction of and promulgated by the Administration of General Services, are available in limited quantities to the general public free of charge from the General Services Administration Regional Offices in various locations; see Paragraph 3-16 entitled *Government Specifications*. Index of the Federal Specifications may be purchased from the U. S. Government Printing Office, Washington, D. C.
3. *Simplified Practice Recommendations* (abbreviated S.P.R. See Appendix 3-4) are issued by the United States Department of Commerce, Commodity Standards Division, and are described as follows:

Simplified Practice Recommendations present in detail the development of programs to eliminate unnecessary variety of sizes, dimensions, styles, and types of (many) commodities. They also contain lists of associations and individuals who have indicated their intention to adhere to the recommendations. These simplified schedules, as formulated and approved by the industries, are indorsed by the Department of Commerce.

Simplified Practice Recommendations may be purchased singly from the U. S. Government Printing Office, Washington 25, D. C. See *Appendix 3-4*.

4. *Commercial Standards* (abbreviated C.S. See Appendix 3-5) are prepared by the United States Department of Commerce, Bureau of Standards, and are described as follows:

Commercial Standards are developed by various industries under a procedure similar to that of simplified practice recommendations. They are, however, primarily concerned with considerations of grade, quality, and such other characteristics as are outside the scope of dimensional simplification.

Commercial Standards may be purchased singly from the U. S. Government Printing Office, Washington 25, D. C. See *Appendix 3-5*.

5. *American Standards* are approved by the American Standards Association, Incorporated, 10 East Fortieth Street, New York 16, New York. This organization is maintained by industry to promote the use of standards. Copies of these standards may be purchased singly from the association.
6. *Military Specifications* (see Paragraph 3-16 and *Appendix 3-2*): When preparing project specifications for the Department of the Air Force, the Department of the Army or the Department of the Navy, reference should be made to the standards issued by each of these



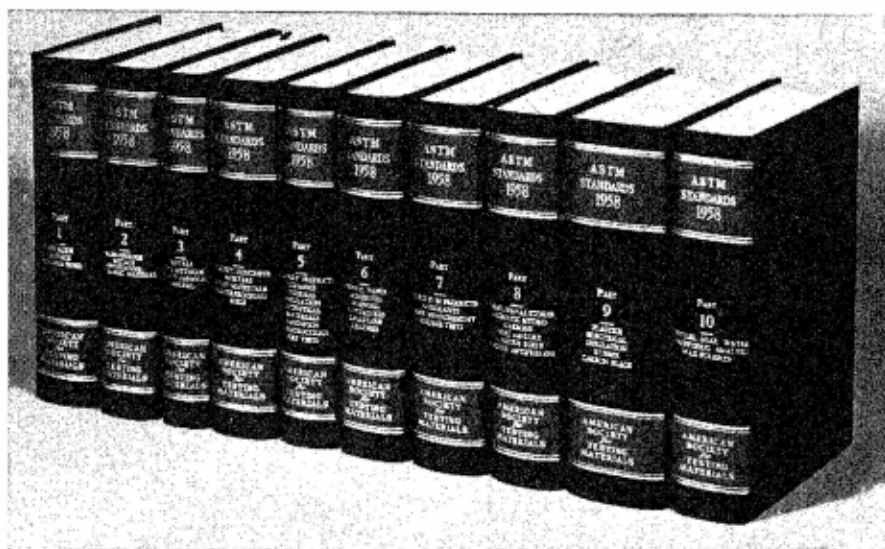


FIG. 3-2 A.S.T.M. STANDARDS

branches of the Federal Government. These standards, however, are rarely, if ever, referred to in project specifications for private work.

- b. Many words would be necessary to describe properly a common product such as portland cement; its chemical composition, fineness, soundness, compressive strength, tensile strength, etc., should be mentioned. All these words are eliminated by a simple reference to the standard, thus:

*"Portland Cement shall meet the requirements of ASTM Spec. C 150, Type I."*

or

*"Portland Cement shall meet the requirements of Fed. Spec. SS-C-192b, Type I."*

- c. An architect should never refer to a standard unless he has a copy of it in his office and has studied the contents. Sometimes it is necessary to select a grade or type, or mention a size which is optional in the standard but may not be optional for the job intended. The standard can be used for speedy settlement of any question regarding a material which may arise during the course of construction.
- d. One should feel no hesitancy in making reference to material standards for fear the manufacturers would not be familiar with them. It is only logical to conclude that a manufacturer who has spent many thousands





have banded together as associations in their common interest. Some of them are referred to as institutes, societies, councils or bureaus, and they promote the use and control of the products and services they represent.

- b. In addition to the promotional activities of these associations, many issue printed documents invaluable to architects, engineers and specification writers. These associations make efforts to control the quality of products and services and they establish grading rules, stock sizes and dimensions, methods of testing, design criteria and codes of ethics. They conduct tests and sometimes certify to tests or grade mark their products. Some prepare and have printed contract forms, bond forms, test reports, specifications, standards, installation guides, tables, recommendations, charts and other data.
- c. The work of these associations and the information compiled by them are made available through skilled specification writers who devote most of their time to specification writing. See *Appendix 3-3* for a selected list of the associations of the construction industry.
- d. Except when he desires proprietary or custom-made products, one of the main objectives of the specification writer is to define the quality of a product, method or service as briefly as possible but not to the extent of excluding competition. There is no better way this can be done than by reference to an association standard.
- e. Actually, a good and thorough trade section can often be written on one or two pages by making an association standard a part of the specification by reference, and then pointing out the essentials required for the job at hand.

### 3-8 LUMBER GRADING RULES

- a. In specifying lumber it is necessary to understand and to use the grading rules established by the various lumber manufacturing associations, including the following:
  - 1. California Redwood Association, San Francisco, Calif.
  - 2. Maple Flooring Manufacturers' Association, Chicago, Ill.
  - 3. National Hardwood Lumber Association, Chicago, Ill.
  - 4. National Oak Flooring Manufacturers' Association, Memphis, Tenn.
  - 5. Northeastern Lumber Manufacturers' Association, New York, N. Y.
  - 6. Northern Hardwood and Pine Manufacturers' Association, Green Bay, Wis.
  - 7. Southern Cypress Manufacturers Association, Jacksonville, Fla.
  - 8. Southern Pine Association, New Orleans, La.
  - 9. West Coast Lumbermen's Association, Portland, Ore.
  - 10. Western Pine Association, Portland, Ore.

11. Western Red Cedar Lumber Association, Seattle, Wash.

- b. If grading rules are not readily available to the specification writer, he can refer to the "Lumber Grade Use Guide" as published by the National Lumber Manufacturers' Association, Washington, D. C., and the tables in Chapters 17 and 18 of this book may be helpful.

### 3-9 MANUFACTURERS' CATALOGS

- a. Manufacturers' catalogs are an important source of reference material for the specification writer. Many of these catalogs contain suggested specifications as well as descriptions and illustrations of products, sizes, finishes and results of tests. Some catalogs are sent to the architect unsolicited, and others may be secured by request.

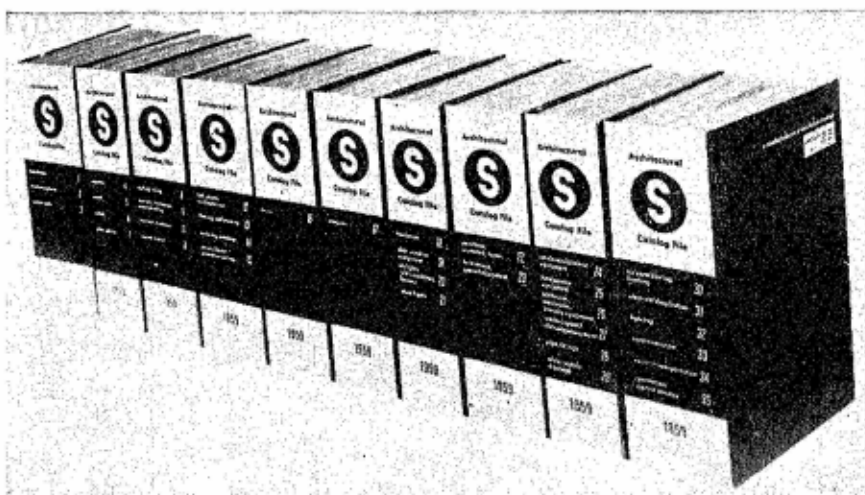


FIG. 3-4 SWEET'S FILE, ARCHITECTURAL

- b. Many catalogs are compiled and distributed to architects each year in several bound volumes known as "Sweet's File, Architectural" (Figure 3-4). These volumes are prepared by Sweet's Catalog Service, 119 West 40th, New York 18, N. Y., a division of the F. W. Dodge Corporation. Instead of having to wrestle with many separate catalogs for filing and reference, "Sweet's" is convenient to handle and thoroughly indexed.

### 3-10 MANUFACTURERS' REPRESENTATIVES

Manufacturers' representatives and material dealers supply architects with much valuable information used in the preparation of drawings and specifications. They call upon the architects to discuss their products with the

hope of having them specified. Architects will do well to give them an attentive ear, for quite a few are trained and have constructive suggestions to offer. After many such interviews the young architect is able to separate the sound advice from the "sales talk" and his knowledge of materials and methods begins to grow with the help of these material dealers and factory representatives. These men can be of greatest assistance to the architect in preparing specifications for special hardware, fixtures and equipment.

### 3-11 GUIDE SPECIFICATIONS

*Guide specifications* furnish information of a more general nature than the manufacturers' catalogs, and also serve as a guide for the wording of sentences and the arrangement of paragraphs and sections. Published *guide specifications* have improved with the years, and the most recently prepared ones are usually the best. Because of the constant changes in the building industry and the continuous introduction of new materials, it is easy to understand how these specifications are quickly outmoded. Published guide specifications include the following:

1. *Streamlined Specification Standards*, Volume I, Architectural, by Ben John Small, Reinhold Publishing Corp., New York, 1952.
2. *Specifications and Costs*, a data book for civil engineers, by Elwyn E. Seelye, John Wiley & Sons, Inc., New York, 1946.
3. *Architectural Specifications* by Harold Reeve Sleeper, A.I.A., John Wiley & Sons, Inc., New York, 1940.
4. *Stevens Master Specifications*, Stevens Master Specifications, Incorporated, 165 W. Wacker Drive, Chicago, 1932.
5. *Specification Record*, American Specification Institute, 205 W. Wacker Drive, Chicago, 1931.
6. *Ready-Written Specifications* by Leicester B. Holland and Harry Parker, John Wiley & Sons, Inc., New York, 1926.

### 3-12 SPECIFICATION WORK SHEETS

The American Institute of Architects (A.I.A.) has published *Specification Work Sheets* prepared by Ben H. Dyer, A.I.A. These work sheets are, as the title implies, dummy sheets to be used for working up the rough specification draft for a specific job. They are prepared in a manner to be marked up, filled in, crossed out and to have inserts added as necessary to fit the job at hand. At the beginning of each section are detailed descriptions and suggested methods of use printed on blue pages entitled, "Reminder Notes for the Architect." These work sheets are published in type-written sheet form and are obtainable from the American Institute of Architects, 1735 New York Avenue, Washington 6, D. C.

### 3-13 SPECIFICATIONS OF PREVIOUS WORK

Specifications of previous work are often used as reference for preparing specifications for jobs of a similar nature. This type of information is not readily available except in well-established architectural firms. Unless the specification used as a model is of recent date and well prepared, there is danger in using it as a guide.

### 3-14 THE CONSTRUCTION SPECIFICATION INSTITUTE, INC.

The Construction Specification Institute, Inc. with headquarters in Washington, D. C. was organized mainly to pool the best specification data, to promote cooperation among all parties affected by specifications and to disseminate specification information. This association publishes for its members a magazine entitled *The Construction Specifier*. From this source one can keep abreast with the latest developments and thoughts on specification writing.

### 3-15 USE OF REFERENCES

The specification writer should acquaint himself with the various reference material available. He should build up a library and develop his files, remembering that the best part of his "knowledge" is only as good as his reference material and his ability to use it.

### 3-16 GOVERNMENT SPECIFICATIONS

- a. No single office or agency of the Federal Government can supply all Military and Federal Specifications.  
General Services Administration (GSA) is responsible for developing and making available to the public *Federal Specifications*.
- b. *Single copies* needed for immediate bidding purposes can be obtained from all GSA Business Service Centers without charge provided the cost is \$1.00 or less. Addresses of these Centers are given in Appendix 3-1.
- c. Federal Specifications needed for other purposes should be bought from: General Services Administration, Region 3, 7th and D Streets, S. W., Washington, D. C. Prices are given in the Index of Federal Specifications, Standards and Handbooks, described below.
- d. *Military Specifications* are *not* distributed by GSA. They are developed and are distributed by Military activities.
- e. When Military Specifications are cited in invitations to bid, the invitation itself usually identifies the office where the specifications can be obtained. Different Military Specifications have different "custodians" who control distribution of these publications. See Appendix 3-2. The

"custodian" of each Military Specification is identified in the Army, Navy and Air Force indices indicated below.

- f. *Federal Specifications* currently in effect, and those cancelled and superseded during the year prior to publication of the index, are identified in the "Index of Federal Specifications, Standards and Handbooks." This publication and monthly supplemental service should be ordered from:

Superintendent of Documents  
U. S. Government Printing Office  
Washington, D. C.

The price is \$1.50 per year.

- g. *Military Specifications* currently in effect and those recently cancelled and superseded are listed in the following publications which are also available from the Superintendent of Documents at the prices indicated:

Index of Specifications and Standards—

Used by—Dept. of the Navy	\$4.00
Used by—Dept. of the Army	4.00
Used by—Dept. of the Air Force	5.00

h. *HOW to get specifications—*

1. GSA distributes *Federal Specifications* and makes no charge for single copies if
    - a. The specification is needed for *immediate* bidding purposes, and
    - b. The cost does not exceed \$1.00 per copy.
  2. GSA does *not* distribute *Military Specifications*. They are available through a number of different military offices; see Appendix 3-2.
  3. Write, telephone, or call in person at the proper office for the publications required.
  4. If additional assistance is needed, contact the nearest Business Service Center of General Services Administration.
- i. The Government encourages the use of *Federal Specifications* in private industry. The more these documents are used, the more standardized become the materials and articles they describe. Thus costs are lowered, and this in turn is beneficial to the Government as well as to the general public. *Federal Specifications* generally describe competitive materials and articles and should not be referred to when premium quality or custom-made items are desired.

## APPENDIX 3-1

## CUSTODIANS OF FEDERAL SPECIFICATIONS

## GENERAL SERVICES ADMINISTRATION BUSINESS SERVICE CENTERS

<i>Location</i>	<i>Office Address, Telephone Number</i>
Atlanta 23, Ga.	Peachtree-7th Bldg., 50 7th St., N.E. Trinity 6-3311
Boston 9, Mass.	Post Office & Court House Bldg. Liberty 2-5600
Chicago 4, Ill.	U. S. Courthouse Bldg., 219 S. Clark Street Harrison 7-4700
Dallas 2, Tex.	1114 Commerce Street Riverside 8-5611
Denver 1, Colo.	Denver Federal Center, Bldg. 41 Belmont 3-3611
Fort Worth 2, Tex.	Federal Center, 300 West Vickery Edison 5351
Kansas City 14, Mo.	GSA Bldg., 2306 E. Bannister Rd. Emerson 1-0860
Los Angeles 12, Calif.	Rm. 101, 417 So. Hill St. Richmond 9-4711
New York 13, N. Y.	250 Hudson Street Algonquin 5-4300
Portland, Ore.	U. S. Courthouse (New), Broadway & Main Streets Capital 8-6171
San Francisco 3, Calif.	49 Fourth Street Yukon 6-3500
Seattle 4, Wash.	Federal Office Bldg., 909 First Avenue Mutual 3300
Washington 25, D. C.	GSA Regional Office Bldg., 7th & D Streets, S.W. Republic 7-7500

## APPENDIX 3-2

## CUSTODIANS OF MILITARY SPECIFICATIONS

## DEPARTMENT OF THE NAVY

Commanding Officer Naval Supply Depot Scotia 2, New York	Chief of Naval Personnel Attn: Material Branch (Pers-22) Dept. of the Navy Washington, D. C.
Commanding Officer Naval Aviation Supply Depot, Attn: ODPT 700 Robbins Ave. Philadelphia 11, Pa.	Chief, Bureau of Ships Attn: Code 357 Dept. of the Navy Washington, D. C.

Chief, Bureau of  
Aeronautics, Technical  
Data Division, Dept. of the Navy  
Washington 25, D. C.

Commandant, U. S.  
Marine Corps—Code CSG  
Hdqrs., U. S. Marine Corps  
Washington 25, D. C.

Chief, Armed Services Medical Pro-  
curement Agency,  
Development  
Engineering & Standards Div.,  
Fort Totten 59, N. Y.

Chief, Bureau of Supplies and  
Accounts,  
Attn: Code S-33,  
Dept. of the Navy  
Washington, D. C.

Chief, Bureau of Yards & Docks,  
Attn: Code C-330  
Dept. of the Navy  
Washington, D. C.

Chief, Bureau of Ordnance  
Attn: Chief Engineer (Rec)  
Dept. of the Navy  
Washington, D. C.

#### DEPARTMENT OF THE AIR FORCE

Commander  
Wright Air Development Center  
Attn: WCXP  
Wright-Patterson Air Force Base, Ohio

#### DEPARTMENT OF THE ARMY

Commanding Officer  
U. S. Army Chemical  
Arsenal, Edgewood  
Attn: Requirements & Specifications  
Office  
Army Chemical Center, Md.

Chief of Engineers  
Dept. of the Army  
Attn: ENGHP  
Washington 25, D. C.

Chief, Armed Services  
Medical Procurement Agency,  
Attn: Development Engineering &  
Standards Division  
Fort Totten 59, N. Y.

Commanding General  
Philadelphia QM Depot  
2800 South 20th St.  
Philadelphia 45, Pa.

Commanding Officer  
Signal Corps Supply Agency,  
225 South 18th Street,  
Philadelphia 3, Pa.

Commanding Officer  
Transportation Supply and Mainte-  
nance Command  
12th and Spruce Streets  
St. Louis, Mo.

Chief of Ordnance  
Department of the Army  
Washington, D. C.



## APPENDIX 3-3

## ASSOCIATIONS OF THE CONSTRUCTION INDUSTRY

*(Reprinted from the Building Science Directory, published by the Building Research Institute, National Academy of Sciences—National Research Council.)*

## A

- ACOUSTICAL CONTRACTORS ASSN., NATL., 1632 K St., N.W., Washington 6, D. C.
- ACOUSTICAL MATERIALS ASSN., 335 E. 45th St., New York 17, N. Y.
- ACOUSTICAL SOCIETY OF AMERICA, 335 E. 45th St., New York 17, N. Y.
- ACTION, INC. (AMERICAN COUNCIL TO IMPROVE OUR NEIGHBORHOODS), 2 W. 46th St., New York 36, N. Y.
- ADHESIVE & SEALANT MANUFACTURERS COUNCIL, RUBBER & PLASTIC, 159 N. Dearborn St., Chicago 1, Ill.
- AGRICULTURAL ENGINEERS, AMERICAN SOCIETY OF, St. Joseph, Mich.
- AIR-CONDITIONING AND REFRIGERATION INSTITUTE, 1346 Connecticut Ave., N.W., Washington 6, D. C.
- AIR CONDITIONING AND REFRIGERATION WHOLESALERS, 1200 W. 5th Ave., Columbus 12, Ohio.
- AIR DISTRIBUTION INSTITUTE, 2130 Keith Bldg., Cleveland 15, Ohio.
- AIR FILTER INSTITUTE, Box 9325, Washington 5, D. C.
- AIR MOVING AND CONDITIONING ASSN., INC., 2159 Guardian Bldg., Detroit 26, Mich.
- AIR POLLUTION CONTROL ASSN., 4400 5th Ave., Pittsburgh 13, Pa.
- ALUMINUM ASSN., 420 Lexington Ave., New York 17, N. Y.
- ALUMINUM EXTRUDERS COUNCIL, 1015 Chestnut St., Philadelphia 7, Pa.
- ANTHRACITE INSTITUTE, 237 Old River Rd., Wilkes-Barre, Pa.
- APARTMENT OWNERS ASSN., INC., NATL., Rm. 305, 1200 18th St., N.W., Washington, D. C.
- APPLIANCE & RADIO-TV DEALERS ASSN., NATL., Merchandise Mart Bldg., Chicago 54, Ill.
- APPLIANCE MANUFACTURERS, INC., INSTITUTE OF, Shoreham Hotel, Washington 8, D. C.
- ARBITRATION ASSN., AMERICAN, 477 Madison Ave., New York 22, N. Y.
- ARCHITECTS, AMERICAN INSTITUTE OF, 1735 New York Ave., N.W., Washington 6, D. C.
- ARCHITECTS, INC., AMERICAN REGISTERED, 622 Mortgage Guarantee Bldg., Atlanta 3, Ga.
- ARCHITECTS FOUNDATION, AMERICAN INSTITUTE OF, 115 E. 40th St., New York, N. Y.
- ARCHITECTURAL REGISTRATION BOARDS, NATL. COUNCIL OF, 418-24 Commerce Exchange Bldg., Oklahoma City, Okla.
- ARCHITECTURE, ASSN. OF WOMEN IN, P.O. Box 1, Clayton 5, Mo.
- ASBESTOS-CEMENT PRODUCTS ASSN., 509 Madison Ave., New York 22, N. Y.
- ASPHALT AND VINYL ASBESTOS TILE INSTITUTE, 101 Park Ave., New York 17, N. Y.
- ASPHALT INSTITUTE, THE, Asphalt Institute Bldg., University of Maryland, College Park, Md.

ASPHALT ROOFING INDUSTRY BUREAU, Rm. 2006, 50 E. 42nd St., New York 17, N. Y.

AUDIO ENGINEERING SOCIETY, Box 12, Old Chelsea Station, New York 11, N. Y.

AUTOCLAVE BUILDING PRODUCTS ASSN., 545 Telegraph Rd., Pontiac, Mich.

AWNING ASSN., NATL. METAL, 280 Madison Ave., New York 16, N. Y.

AWNING INSTITUTE, CANVAS, P.O. Box 9907, Memphis 12, Tenn.

## B

BALLAST MANUFACTURERS ASSN., CERTIFIED, 2116 Keith Bldg., Cleveland 15, Ohio.

BANKERS ASSN., AMERICAN, 12 E. 36th St., New York 16, N. Y.

BANKERS ASSN., AMERICAN INDUSTRIAL, 813 Washington Bldg., Washington 5, D. C.

BANKERS ASSN. OF AMERICA, MORTGAGE, 111 W. Washington St., Chicago 2, Ill.

BANKS, NATL. ASSN. OF MUTUAL SAVINGS, 60 E. 42nd St., New York 17, N. Y.

BETTER LIGHT-BETTER SIGHT BUREAU, 750 3rd Ave., New York 17, N. Y.

BLUEPRINTS & ALLIED INDUSTRIES, INTL. ASSN. OF, 33 E. Congress Pkwy., Chicago 5, Ill.

BLUEPRINT AND DIAZOTYPE COATERS, NATL. ASSN. OF, 1757 K St., N.W., Washington 6, D. C.

BOILER AND RADIATOR MANUFACTURERS, INSTITUTE OF, 608 5th Ave., New York 20, N. Y.

BOILER INSTITUTE, STEEL, Land Title Bldg., Philadelphia 10, Pa.

BOILER MANUFACTURERS ASSN., AMERICAN, Raymond Commerce Bldg., 1180 Raymond Blvd., Newark 2, N. J.

BRICK & TILE MANUFACTURERS ASSN., SOUTHERN, 230 Spring St., N.W., Atlanta 3, Ga.

BRIDGE, TUNNEL AND TURNPIKE ASSN., AMERICAN, Box 748, White Plains, N. Y.

BUILDERS EXCHANGE EXECUTIVES, INTL., 393 Techwood Dr., N.W., Atlanta 13, Ga.

BUILDING CLEANING AND WATER-PROOFING CONTRACTORS ASSN., 350 5th Ave., New York 1, N. Y.

BUILDING CODE CONGRESS, SOUTHERN, Brown-Marx Bldg., Birmingham, Ala.

BUILDING MATERIAL DISTRIBUTORS ASSN., INC., NATL., 22 W. Monroe St., Chicago 3, Ill.

BUILDING MATERIAL EXHIBITORS ASSN., Box 103, 1201 Waukegan Rd., Glenview, Ill.

BUILDING OFFICIALS CONFERENCE OF AMERICA, INC., 1525 E. 53rd St., Chicago 15, Ill.

BUILDING OFFICIALS, INTL. CONFERENCE OF, 610 S. Broadway, Los Angeles 14, Calif.

BUILDING OWNERS AND MANAGERS, NATL. ASSN. OF, 134 S. LaSalle St., Chicago 3, Ill.

BUILDING RESEARCH ADVISORY BOARD, Natl. Academy of Sciences-Natl. Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

BUILDING RESEARCH INSTITUTE, Natl. Academy of Sciences-Natl. Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

## C

CALCIUM CHLORIDE INSTITUTE, 1200 18th St., N.W., Washington 6, D. C.

CANVAS PRODUCTS ASSN., INTL., 224 Endicott Bldg., St. Paul 1, Minn.

CARPET INSTITUTE, INC., AMERICAN, 350 5th Ave., New York 1, N. Y.

CASUALTY & SURETY COMPANIES, ASSN. OF, 60 John St., New York 38, N. Y.

CEDAR ASSN., WESTERN RED & NORTHERN WHITE, 500 Investors Bldg., Minneapolis 2, Minn.

CEDAR LUMBER ASSN., WESTERN RED, White-Henry-Stuart Bldg., Seattle, Wash.

CEMENT ASSN., INC., OXYCHLORIDE, 29-28 41st Ave., Long Island City, N. Y.

CENTRAL SUPPLY ASSN. (Plumbing & Heating Wholesalers), 221 N. La-Salle St., Chicago 1, Ill.

CERAMIC ENGINEERS, NATL. INSTITUTE OF, 204 Ceramics Bldg., Univ. of Illinois, Urbana, Ill.

CERAMIC SOCIETY, INC., AMERICAN, 4055 N. High St., Columbus 14, Ohio.

CHAMBER OF COMMERCE OF THE U. S., CONSTRUCTION AND CIVIC DEVELOPMENT DEPT., 1615 H St., N.W., Washington 6, D. C.

CHARCOAL GRILL MANUFACTURERS ASSN., Shoreham Hotel, Washington 8, D. C.

CHEMICAL ENGINEERS, THE AMERICAN INSTITUTE OF, 25 W. 45th St., New York, N. Y.

CHEMICAL SOCIETY, AMERICAN, 1155 16th St., N.W., Washington 6, D. C.

CHEMICAL SPECIALTIES MANUFACTURERS ASSN., 50 E. 41st St., New York 17, N. Y.

CHEMISTS AND CHEMICAL ENGINEERS, INC., ASSN. OF CONSULTING, 50 E. 41st St., New York 17, N. Y.

CHEMISTS ASSN., INC., MANUFACTURING, 1825 Connecticut Ave., N.W., Washington 6, D. C.

CHURCH ARCHITECTURAL GUILD OF AMERICA, 1346 Connecticut Ave., N.W., Washington 6, D. C.

CINDER CONCRETE PRODUCTS ASSN., NATL., P.O. Box 67, Primos, Pa.

CIVIL ENGINEERS, AMERICAN SOCIETY OF, 33 W. 39th St., New York 18, N. Y.

CLAY AND SHALE ASSN., EXPANDED, P.O. Box 94, Alpena, Mich.

CLAY FLUE LINING INSTITUTE, 161 Ash St., Akron 8, Ohio.

CLAY PIPE INSTITUTE, 315 W. 9th St., Los Angeles 15, Calif.

CLAY PIPE INSTITUTE, INC., SOUTHERN, Rm. 406, 1401 Peachtree St., N.E., Atlanta 9, Ga.

CLAY PIPE MANUFACTURERS, INC., NATL., 1820 N. St., N.W., Washington 6, D. C.

CLAY PRODUCTS ASSN., Box 172, Barrington, Ill.

CLAY PRODUCTS INSTITUTE, STRUCTURAL, 1520 18th St., N.W., Washington 6, D. C.

CLAY PRODUCTS, NATL. ASSN. OF DISTRIBUTORS & DEALERS OF STRUCTURAL, 120 Middlesex Ave., Somerville, Mass.

CLAY PRODUCTS RESEARCH FOUNDATION, STRUCTURAL, Geneva, Ill.

CLAY SEWER PIPE ASSN., INC., Rm. 311 High-Long Bldg., 5 E. Long St., Columbus 15, Ohio.

(Clay: See also Brick, Masonry)

COAL ASSN., NATL., 802 Southern Bldg., Washington 5, D. C.

COAL RESEARCH, INC., BITUMINOUS, 121 Meyran Ave., at Forbes, Pittsburgh 13, Pa.

COLOR COUNCIL, INTER-SOCIETY, Color Technology Div., Bldg. 65, Eastman Kodak Co., Rochester 4, N. Y.

COLUMN RESEARCH COUNCIL OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, 313 West Engineering, University of Michigan, Ann Arbor, Mich.

CONCRETE ASSN., NATL. READY MIXED, Munsey Bldg., Washington 4, D. C.

CONCRETE INDUSTRY BOARD, INC., 220 E. 42nd St., New York 17, N. Y.

CONCRETE INSTITUTE, AMERICAN, P.O. Box 4754, Redford Station, Detroit 19, Mich.

CONCRETE INSTITUTE, PRESTRESSED, 205 W. Wacker Dr., Chicago 6, Ill.

CONCRETE MASONRY ASSN., NATL., 1015 Wisconsin Ave., N.W., Washington 6, D. C.

CONCRETE PIPE ASSN., AMERICAN, 228 N. LaSalle St., Chicago 1, Ill.

CONCRETE REINFORCING STEEL INSTITUTE, 38 S. Dearborn St., Chicago 3, Ill.

CONDUIT SECTION, BITUMINOUS (NEMA), 155 E. 44th St., New York 17, N. Y.

CONSTRUCTION SUPERINTENDENTS, INC., SOCIETY OF, 38 Park Row, New York 38, N. Y.

CONSTRUCTORS ASSN., NATL., 60 E. 42nd St., New York 17, N. Y.

CONTRACT INFORMATION, BUREAU OF, Tower Bldg., 1401 K St., N.W., Washington 5, D. C.

(Contractors: See General, Mechanical, etc.)

CONVEYOR EQUIPMENT MANUFACTURERS ASSN., 1 Thomas Circle, Washington 5, D. C.

COOLING TOWER INSTITUTE, 1120 W. 43rd St., Houston 18, Texas.

COPPER & BRASS RESEARCH ASSN., 420 Lexington Ave., New York 17, N. Y.

COPPER ASSN., U. S., 50 Broadway, New York 4, N. Y.

COPPER INSTITUTE, 50 Broadway, New York 4, N. Y.

CORK INSTITUTE OF AMERICA, 342 Madison Ave., New York 17, N. Y.

CORROSION ENGINEERS, NATL. ASSN. OF, 1061 M & M Bldg., Houston 2, Texas.

(Corrosion: See also Deterioration)

CRANE & SHOVEL ASSN., POWER, 631 3rd Ave., New York 17, N. Y.

CRANE INSTITUTE, ELECTRIC OVERHEAD, 1 Thomas Circle, N.W., Washington 5, D. C.

CYPRESS MANUFACTURERS ASSN., SOUTHERN, P.O. Box 5772, 1037 Hendricks Ave., Jacksonville 7, Fla.

## D

DECORATORS, AMERICAN INSTITUTE OF, 673 5th Ave., New York 22, N. Y.

DESIGN LEGISLATION, NATL. COMMITTEE FOR EFFECTIVE, Suite 2700, 200 E. 42nd St., New York 17, N. Y.

DETERIORATION CENTER, PREVENTION OF, Natl. Academy of Sciences, Natl. Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

DIE CASTING INSTITUTE, AMERICAN, 366 Madison Ave., New York 17, N. Y.

DISTRIBUTORS COUNCIL, INC., 3329 8th St., N.E., Washington 17, D. C.

DOOR AND WINDOW INSTITUTE, SLIDING GLASS, 6132 Whittier Blvd., Los Angeles 22, Calif.

DOOR ASSN., NATL., 9304 Sunset Blvd., Los Angeles 46, Calif.

DOOR INSTITUTE, STEEL, 2130 Keith Bldg., Cleveland 15, Ohio.

DOOR OPERATOR AND REMOTE CONTROL ASSN., 110 N. Wacker Drive, Chicago, Ill.

DOUGLAS FIR EXPORT CO., Yeon Bldg., Portland 4, Ore.

DRYWALL CONTRACTORS ASSN., THE INTL., 608 S. Hill St., Los Angeles, Calif.

## E

ELECTRIC INSTITUTE, EDISON, 750 3rd Ave., New York 17, N. Y.

ELECTRIC FUSE MANUFACTURERS GUILD, 53 Park Pl., New York 7, N. Y.

ELECTRIC TOOL INSTITUTE, 318 Henrietta St., Kalamazoo, Mich.

(Electric: See also Illuminating, Incandescent, Better)

ELECTRICAL CONTRACTORS ASSN., NATL., 1200 18th St., N.W., Washington 6, D. C.

ELECTRICAL DISTRIBUTORS, NATL. ASSN. OF, 290 Madison Ave., New York 17, N. Y.

ELECTRICAL ENGINEERS, AMERICAN INSTITUTE OF, 33 W. 39th St., New York 18, N. Y.

ELECTRICAL MANUFACTURERS ASSN., NATL., 155 E. 44th St., New York 17, N. Y.

ELECTRONIC DISTRIBUTORS ASSN., NATL., Suite 1414, 343 S. Dearborn St., Chicago 4, Ill.

ELECTROPLATERS SOCIETY, INC., AMERICAN, 445 Broad St., Newark, N. J.

ELEVATOR CONTRACTORS, NATL., ASSN. OF, 611 Olive St., St. Louis 1, Mo.

ELEVATOR MANUFACTURING INDUSTRY, NATL., 101 Park Ave., New York 17, N. Y.

EMPLOYERS' ASSN., BUILDING TRADES, 711 3rd Ave., New York 17, N. Y.

EMPLOYERS ASSN., CONSTRUCTION, 2565 St. Marys Ave., Omaha, Neb.

ENGINEERING COLLEGE RESEARCH COUNCIL, New York University, University Heights, New York 53, N. Y.

ENGINEERING COMPANIES, NATL. ASSN. OF, 1800 Ruhl Bldg., Detroit 26, Mich.

ENGINEERING EDUCATION, AMERICAN SOCIETY FOR, University of Illinois, Urbana, Ill.

ENGINEERING EXAMINERS, NATL. COUNCIL OF STATE BOARDS OF, Drawer 1404 Columbia, S. C.

ENGINEERING FOUNDATION, 29 W. 39th St., New York 18, N. Y.

ENGINEERS, AMERICAN ASSN. OF, 8 S. Michigan Ave., Chicago 3, Ill.

ENGINEERS, AMERICAN INSTITUTE OF CONSULTING, 33 W. 39th St., New York 18, N. Y.

ENGINEERS COUNCIL, CONSULTING, 326 Reisch Bldg., Springfield, Ill.

ENGINEERS COUNCIL FOR PROFESSIONAL DEVELOPMENT, 29 W. 39th St., New York 18, N. Y.

ENGINEERS JOINT COUNCIL, 29 W. 39th St., New York 18, N. Y.

ENGINEERS, NATL. SOCIETY OF PROFESSIONAL, 2029 K St., N.W., Washington 6, D. C.

ENGINEERS, SOCIETY OF WOMEN, 29 W. 39th St., 11th Fl., New York 18, N. Y.

(Engineers: See also Agricultural, Heating, Mechanical, etc.)

EQUIPMENT DISTRIBUTORS, ASSOCIATED, 30 E. Cedar St., Chicago 11, Ill.

EXPANSION JOINT INSTITUTE, 1460 E. River Rd., South Aurora, Ill.

EXPANSION JOINT MANUFACTURERS ASSN., 53 Park Pl., New York 7, N. Y.

## F

FASTENERS INSTITUTE, INDUSTRIAL, 1517 Terminal Tower, Cleveland 13, Ohio.

FELT ASSN., 631 3rd Ave., New York 17, N. Y.

FIRE EQUIPMENT MANUFACTURERS ASSN., 759 One Gateway Center, Pittsburgh 22, Pa.

FIRE INSURANCE COMPANIES, ASSOCIATED FACTORY MUTUAL, Factory Mutual Engineering Div., 1151 Boston Providence Turnpike, Norwood, Mass.

FIRE INSURANCE ENGINEERS, ASSN. OF MUTUAL, 15 N. Broadway, White Plains, N. Y.

FIRE PROTECTION ASSN., NATL., 60 Battery March St., Boston 10, Mass.

FIRE PROTECTION ENGINEERS, SOCIETY OF, 60 Battery March St., Boston 10, Mass.

FIRE UNDERWRITERS, NATL. BOARD OF, 85 John St., New York 38, N. Y.

FIREPLACE EQUIPMENT MANUFACTURERS ASSN., 332 S. Michigan Ave., Chicago 4, Ill.

FLOOR AND VACUUM MACHINERY MANUFACTURERS ASSN., Carlton Hotel, Oak Park, Ill.

FLOOR COVERINGS COUNCIL, NATL. RETAIL, Suite 810, Harrison Bldg., 4 S. 15th St., Philadelphia 2, Pa.

FLOOR INSTITUTE OF AMERICA, WOOD, 201 N. Wells St., Chicago 6, Ill.

FLOORING COUNCIL, RUBBER AND VINYL, 444 Madison Ave., New York 22, N. Y.

FLOORING MANUFACTURERS ASSN., MAPLE, 35 E. Wacker Dr., Chicago 1, Ill.

FLOORING MANUFACTURERS ASSN., NATL. OAK, 814 Sterick Bldg., Memphis 3, Tenn.

FOREST INDUSTRIES, PACIFIC, P.O. Box 1393, Tacoma 1, Wash.

FOREST INDUSTRIES ASSN., WESTERN, 526 Henry Bldg., 309 S. W. 4th Ave., Portland 4, Ore.

FOREST PRODUCTS INDUSTRIES, INC., AMERICAN, 1816 N St., N.W., Washington 6, D. C.

FOREST PRODUCTS RESEARCH SOCIETY, P.O. Box 2010, University Station, Madison, Wis.

FORESTRY ASSN., AMERICAN, 919 17th St., N.W., Washington 6, D. C.

FUEL OIL COUNCIL, INTERNATIONAL, 424 Madison Ave., New York 17, N. Y.

## G

GALVANIZERS ASSN., AMERICAN HOT DIP, First Natl. Bank Bldg., Pittsburgh 22, Pa.

(Galvanizers: See also Electroplaters)

GAS APPLIANCE MANUFACTURERS ASSN., 60 E. 42nd St., New York 17, N. Y.

GAS ASSN., INC., AMERICAN, 420 Lexington Ave., New York 17, N. Y.

GAS ASSN. HOME BUREAU, AMERICAN, 420 Lexington Ave., New York 17, N. Y.

GAS ASSN., LIQUEFIED PETROLEUM, 11 S. LaSalle St., Chicago 3, Ill.

GAS VENT INSTITUTE, 332 S. Michigan Ave., Chicago 4, Ill.

GENERAL CONTRACTORS ASSN., 341 Madison Ave., New York 17, N. Y.

GENERAL CONTRACTORS OF AMERICA, INC., ASSOCIATED, 20th & E Sts., N.W., Washington 6, D. C.

GLASS ASSN. OF AMERICA, STAINED, 822 Wilmington Ave., St. Louis 11, Mo.

GLASS ASSN., STAINED AND LEADED, 58 W. 15th St., New York 11, N. Y.

GLASS JOBBERS ASSN., FLAT, 2217 Tribune Tower, Chicago 11, Ill.

GLUE MANUFACTURERS, INC., NATL. ASSN. OF, 55 W. 42nd St., New York 36, N. Y.

GRANITE ASSN., INC., BARRE, 51 Church St., Barre, Vt.

GRANITE QUARRIES ASSN., NATL. BLDG., 1028 Connecticut Ave., Washington 6, D. C.

GYPSUM ASSN., 201 N. Wells St., Chicago 6, Ill.

GYPSUM DRYWALL CONTRACTORS INTL., Suite 1010, 608 S. Hill St., Los Angeles 14, Calif.

## H

HARDBOARD ASSN., 205 W. Wacker Dr., Chicago 6, Ill.

HARDWARE ASSN., NATL. BUILDERS, 515 Madison Ave., New York 22, N. Y.

HARDWARE ASSN., NATL. RETAIL, 964 N. Pennsylvania St., Indianapolis 4, Ind.

HARDWARE ASSN., NATL. WHOLESALE, 1900 Arch St., Philadelphia 3, Pa.

HARDWARE CONSULTANTS, AMERICAN SOCIETY OF ARCHITECTURAL, 220 E St., Santa Rosa, Calif.

HARDWARE MANUFACTURERS ASSN., AMERICAN, 342 Madison Ave., New York 17, N. Y.

HARDWARE MANUFACTURERS ASSN., THE DRAPERY, 53 Park Pl., New York 7, N. Y.

HARDWARE MANUFACTURERS STATISTICAL ASSN., 205 Church St., New Haven 6, Conn.

HARDWOOD AND PINE MANUFACTURERS ASSN., NORTHERN, 4329 Oakland Ave., Minneapolis 7, Minn.

HARDWOOD DIMENSION MANUFACTURERS ASSN., 3813 Hillsboro Road, Nashville 12, Tenn.

HARDWOOD LUMBER ASSN., NATL., 59 E. Van Buren St., Chicago 5, Ill.

HARDWOOD PLYWOOD INSTITUTE, 2310 S. Walter Reed Dr., P.O. Box 6246, Arlington, Va.

HARDWOOD MANUFACTURERS, INC., APPALACHIAN, 414 Walnut St., Cincinnati 2, Ohio.

HARDWOOD PRODUCERS, INC., SOUTHERN, 805 Sterick Bldg., Memphis, Tenn.

HARDWOODS ASSN., FINE, Rm. 1730, 666 N. Lake Shore Dr., Chicago 11, Ill.

HEAT EXCHANGE INSTITUTE, 122 E. 42nd St., New York 17, N. Y.

HEAT INSTITUTE OF AMERICA, INC., OIL, 500 5th Ave., New York 36, N. Y.

HEATING & AIR CONDITIONING ASSN., NATL. WARM AIR, 640 Engineers Bldg., Cleveland 14, Ohio.

HEATING & AIR CONDITIONING INDUSTRIES, INC., INSTITUTE OF, 1254 W. Manchester Ave., Los Angeles 44, Calif.

HEATING & AIR CONDITIONING WHOLESALE, INC., NORTH AMERICAN, 1200 W. 5th Ave., Columbus 12, Ohio.

HEATING ASSN., NATL. DISTRICT, 827 N. Euclid Ave., Pittsburgh 6, Pa.

HEATING-COOLING COUNCIL, BETTER, 250 Park Ave., New York 17, N. Y.

HEATING EQUIPMENT ASSN., INDUSTRIAL, 1145 19th St., N.W., Washington 6, D. C.

HEATING EQUIPMENT MANUFACTURERS ASSN., STEAM, Barnes & Jones, Inc., Newtonville, Boston, Mass.

HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, AMERICAN SOCIETY OF, 234 5th Ave., New York 1, N. Y.

HOIST MANUFACTURERS ASSN., 1 Thomas Circle, N.W., Washington 5, D. C.

HOME BUILDERS, NATL. ASSN. OF, 1625 L St., N.W., Washington 6, D. C.

HOME ECONOMICS ASSN., AMERICAN, 1600 12th St., N.W., Washington 9, D. C.

HOME IMPROVEMENT COUNCIL, 2 E. 54th St., Rm. 601, New York 22, N. Y.

HOME IMPROVEMENT PRODUCTS ASSN., 280 Madison Ave., New York 16, N. Y.

HOME MANUFACTURERS ASSN., 1117 Barr Bldg., 910 17th St., N.W., Washington 6, D. C.

HOUSING AND REDEVELOPMENT OFFICIALS, NATL. ASSN. OF, 1313 E. 60th St., Chicago 37, Ill.

HOUSING CONFERENCE, NATL., 1025 Connecticut Ave., N.W., Washington 6, D. C.

HYGIENE ASSN., AMERICAN INDUSTRIAL, 14125 Prevost, Detroit 27, Mich.

HYGIENE FOUNDATION OF AMERICA, INDUSTRIAL, 4400 5th Ave., Pittsburgh 13, Pa.

(Hygiene: See also Sanitation)

I

ILLUMINATING ENGINEERING RESEARCH INSTITUTE, 1860 Broadway, New York 23, N. Y.

ILLUMINATING ENGINEERING SOCIETY, 1860 Broadway, New York 23, N. Y.

INCINERATOR INSTITUTE OF AMERICA, 420 Lexington Ave., New York 17, N. Y.

INDUSTRIAL DEVELOPMENT COUNCIL, AMERICAN, RFD #3 Red Mill Rd., Newark, Del.

INDUSTRIAL ENGINEERS, AMERICAN INSTITUTE OF, 145 N. High St., Columbus 15, Ohio.

INSULATING SIDING ASSN., Box 103, 1201 Waukegan Rd., Glenview, Ill.

INSULATING SIDING CORE BOARD ASSN., Box 103, 1201 Waukegan Rd., Glenview, Ill.

INSULATION BOARD INSTITUTE, 111 W. Washington St., Chicago 2, Ill.

INSULATION DISTRIBUTOR-CONTRACTORS NATL. ASSN., 1632 K St., N.W., Suite 14, Washington 6, D. C.

INSULATION MANUFACTURERS ASSN., NATL., 441 Lexington Ave., New York 17, N. Y.

(Insulation: See also Roofing)

INSURANCE ASSN. FACTORY, 85 Woodland St., Hartford 2, Conn.



(Insurance: See also Fire, Casualty)

IRON & STEEL ENGINEERS, ASSN. OF,  
1010 Empire Bldg., Pittsburgh 22, Pa.

IRON AND STEEL INSTITUTE, AMERICAN,  
150 E. 42nd St., New York 17, N. Y.

(Iron: See also Engineers, Pipe, etc.)

## K

KITCHEN CABINET INSTITUTE, WOOD,  
350 5th Ave., New York 1, N. Y.

KITCHEN CABINET MANUFACTURERS  
ASSN., STEEL, Engineers Bldg., Cleve-  
land 14, Ohio.

KITCHEN CABINETS, NATL. INSTITUTE OF  
WOOD, 75 E. Wacker Dr., Chicago  
1, Ill.

KRAFT PAPER ASSN., INC., 122 E. 42nd  
St., New York 17, N. Y.

## L

LABORATORIES, INC., AMERICAN COUN-  
CIL OF INDEPENDENT, 4302 East-West  
Highway, Washington 14, D. C.

LAMP MANUFACTURERS ASSN., INCAN-  
DESCENT, 67 S. Munn Ave., East  
Orange, N. J.

LANDSCAPE ARCHITECTS, AMERICAN SO-  
CIETY OF, 9 Park St., Boston 8, Mass.

LANDSCAPE NURSERYMEN'S ASSN.,  
NATL., 8620 Crest Rd., Minneapolis  
20, Minn.

LATHING AND PLASTERING, NATL. BU-  
REAU FOR, 311 Tower Bldg., 1401 K  
St., N.W., Washington 5, D. C.

LATHING FOUNDATION OF CHICAGO,  
221 N. LaSalle St., Chicago, Ill.

LAUNDRY MANUFACTURERS ASSN.,  
AMERICAN HOME, 20 N. Wacker Dr.,  
Chicago 6, Ill.

LEAD INDUSTRIES ASSN., 292 Madison  
Ave., New York 17, N. Y.

LICENSE LAW OFFICIALS, NATL. ASSN.  
OF, Berger Bldg., Pittsburgh 19, Pa.

LIGHTING ASSN., FLUORESCENT, 1270  
Broadway, New York 1, N. Y.

LIGHTING INSTITUTE, AMERICAN HOME,  
360 N. Michigan Ave., Chicago 1, Ill.

(Lighting: See also Better, Lamp, Electric)

LIME ASSN., NATL., 925 15th St., N.W.,  
Washington 5, D. C.

LIME ASSN. OF OHIO, FINISHING, 240  
Huron St., Toledo 4, Ohio.

LIMESTONE INSTITUTE, INDIANA, P.O.  
Box 471, Bedford, Ind.

LOGGERS ASSN., PACIFIC NORTHWEST,  
4425 White-Henry-Stuart Bldg., Seat-  
tle 1, Wash.

LUMBER ASSN., INC., NATL.-AMERICAN  
WHOLESALE, 3 E. 44th St., New York  
17, N. Y.

LUMBER ASSN., SOUTHERN WHOLESALE,  
McMillan Bank Bldg., Livingston, Ala.

LUMBER ASSN., WESCOSA, 2 Pine St.,  
San Francisco 11, Calif.

LUMBER DEALERS ASSN., NATL. RETAIL,  
Suite 302, 1200 18th St., N.W., Wash-  
ington 6, D. C.

LUMBER DEALERS RESEARCH COUNCIL,  
1828 Jefferson Pl., N.W., Washington  
6, D. C.

LUMBER DISTRIBUTING YARD ASSN., INC.,  
NATL. WHOLESALE, % Charles Holyoke  
Lumber Corp., Charlestown, Mass.

LUMBER EXPORTERS ASSN., NATL., 805  
Sterick Bldg., Memphis 3, Tenn.

LUMBER INSPECTION BUREAU, PACIFIC,  
White-Henry-Stuart Bldg., Seattle 1,  
Wash.

LUMBER INSPECTION BUREAU, WEST  
COAST, 1410 S. W. Morrison St., Port-  
land 5, Ore.

LUMBER MANUFACTURERS ASSN., NATL., 1319 18th St., N.W., Washington 6, D. C.

LUMBER MANUFACTURERS ASSN., INC., NORTHEASTERN, 271 Madison Ave., New York 16, N. Y.

(Lumber: See also various species, and Forest, Timber, Wood)

LUMBERMEN'S ASSN., WEST COAST, 1410 S. W. Morrison St., Portland 5, Ore.

### M

MAHOGANY ASSN., INC., PHILIPPINE, 1017 Fair Oaks Ave., S. Pasadena, Calif.

MALLEABLE FOUNDERS SOCIETY, 781 Union Commerce Bldg., Cleveland 14, Ohio.

MANUFACTURERS ASSN., CONSTRUCTION INDUSTRY, 135 S. LaSalle St., Chicago 3, Ill.

MARBLE DEALERS, NATL. ASSN. OF, Tennessee Marble Co., Knoxville, Tenn.

MARBLE INSTITUTE OF AMERICA, INC., 32 S. 5th Ave., Mt. Vernon, N. Y.

MASON CONTRACTORS ASSN. OF AMERICA, 208 S. LaSalle St., Chicago 4, Ill.

MASONRY INSTITUTE, INC., Washington Bldg., 15th St. & New York Ave., N.W., Washington 5, D. C.

MATERIAL HANDLING INSTITUTE, INC., 1 Gateway Center, Pittsburgh 22, Pa.

MATERIAL HANDLING SOCIETY, AMERICAN, 3737 Upton Ave., Toledo 13, Ohio.

MECHANICAL CONTRACTORS ASSN. OF AMERICA, INC., Suite 570, 45 Rockefeller Plaza, New York 20, N. Y.

MECHANICAL ENGINEERS, AMERICAN SOCIETY OF, 29 W. 39th St., New York 18, N. Y.

METAL BUILDING MANUFACTURERS ASSN., % Thomas Associates, Inc., 2130 Keith Bldg., Cleveland 15, Ohio.

METAL INDUSTRIES, ALLIED BUILDING, 101 Park Ave., New York 17, N. Y.

METAL LATH MANUFACTURERS ASSN., 636 Engineers Bldg., Cleveland 14, Ohio.

METAL MANUFACTURERS, NATL. ASSN. OF ARCHITECTURAL, 228 N. LaSalle St., Chicago 1, Ill.

METAL ROOF DECK TECHNICAL INSTITUTE, 53 W. Jackson Blvd., Chicago 4, Ill.

METAL STATISTICS, AMERICAN BUREAU OF, 50 Broadway, New York 4, N. Y.

METALS, AMERICAN SOCIETY FOR, Metals Park, Novelty, Ohio.

MICA ASSN., INC., WET GROUND, 420 Lexington Ave., New York 17, N. Y.

MICROBIOLOGY, SOCIETY FOR INDUSTRIAL, Purdue University, Lafayette, Ind.

MILITARY ENGINEERS, SOCIETY OF AMERICAN, Mills Bldg., Washington 6, D. C.

MINERAL WOOL ASSN., NATL., 1270 6th Ave., Rockefeller Center, New York 20, N. Y.

MINING, METALLURGICAL AND PETROLEUM ENGINEERS, INC., AMERICAN INSTITUTE OF, 29 W. 39th St., New York 18, N. Y.

MIRROR MANUFACTURERS ASSN., 2217 Tribune Tower, Chicago 11, Ill.

MIXER MANUFACTURERS BUREAU, AGC Bldg., 20th & E Sts., N.W., Washington 6, D. C.

MOBILE HOMES MANUFACTURERS ASSN., 20 N. Wacker Dr., Chicago 6, Ill.

MOBILEHOME DEALERS NATL. ASSN., 39 S. LaSalle St., Chicago 3, Ill.

MODULAR BUILDING STANDARDS ASSN.,  
2029 K St., N.W., Washington 6, D. C.

MOSAI ASSOCIATES, P.O. Box 606,  
New Haven 3, Conn.

MUTUAL LOSS RESEARCH BUREAU, 20  
N. Wacker Dr., Chicago 6, Ill.

## N

NURSERYMEN, AMERICAN ASSN. OF,  
Rm. 636, Southern Bldg., Washington  
5, D. C.

(Nursery: See also Landscape)

## O

OVERSEAS AMERICANS, INC., CON-  
STRUCTION DIVISION, 7 W. 44th St.,  
New York 36, N. Y.

## P

PAINT & WALLPAPER DISTRIBUTORS OF  
AMERICA, RETAIL, 8131 Delmar, St.  
Louis 30, Mo.

PAINT RESEARCH INSTITUTE, P.O. Box  
593, New Albany, Ind.

PAINT TECHNOLOGY, FEDERATION OF  
SOCIETIES FOR, 121 Broad St., Phila-  
delphia 7, Pa.

PAINT, VARNISH & LACQUER ASSN.,  
INC., NATL., 1500 Rhode Island Ave.,  
N.W., Washington 5, D. C.

PAINTING AND DECORATING CON-  
TRACTORS OF AMERICA, 2625 W. Peter-  
son Ave., Chicago 45, Ill.

PAINTING & FINISHING EQUIPMENT  
ASSN., NATL. SPRAY, 300 Phillips Ave.,  
Toledo 12, Ohio

PAPER AND BOARD AFFILIATES, INC.,  
SPECIALTY, 122 E. 42nd St., New York  
17, N. Y.

PAPER AND PULP ASSN., AMERICAN, 122  
E. 42nd St., New York 17, N. Y.

PAPER MANUFACTURERS ASSN., INC.,  
WATERPROOF, 122 E. 42nd St., New  
York 17, N. Y.

PAPERBOARD ASSN., NATL., 80 E. Jack-  
son Blvd., Chicago 4, Ill.

PERLITE INSTITUTE, 45 W. 45th St., New  
York 36, N. Y.

PEST CONTROL ASSN., INC., NATL., 250  
W. Jersey St., Elizabeth, N. J.

PINE ASSN., SOUTHERN, 520 Natl. Bank  
of Commerce Bldg., P.O. Box 1170  
New Orleans 4, La.

PINE ASSN., WESTERN, 510 Yeon Bldg.,  
Portland, Ore.

PINE BUREAU, ARKANSAS SOFT, Boyle  
Bldg., Little Rock, Ark.

PINE INSPECTION BUREAU, SOUTHERN,  
520 Natl. Bank of Commerce Bldg.,  
P.O. Box 1170, New Orleans 4, La.

PINE MANUFACTURERS ASSN., NORTH-  
ERN, 4329 Oakland Ave., Minneapolis  
7, Minn.

PINE WOODWORK ASSN., PONDEROSA,  
39 S. LaSalle St., Chicago 3, Ill.

PIPE FABRICATION INSTITUTE, 1 Gate-  
way Center, Pittsburgh 22, Pa.

PIPE FITTINGS MANUFACTURERS ASSN.,  
60 E. 42nd St., New York 17, N. Y.

PIPE INSTITUTE, BITUMINOUS, 370 Lex-  
ington Ave., New York 17, N. Y.

PIPE INSTITUTE, CAST IRON PRESSURE,  
5120 Manning Dr., Bethesda 14, Md.

PIPE INSTITUTE, CAST IRON SOIL, 205  
W. Wacker Dr., Chicago 6, Ill.

PIPE NIPPLE MANUFACTURERS, NATL.  
ASSN. OF, 501 5th Ave., New York 17,  
N. Y.

PIPE RESEARCH ASSN., CAST IRON, Suite  
3440, Prudential Plaza, Chicago 1, Ill.

PIPE TOOL MANUFACTURERS INSTITUTE, 53 Park Pl., New York 7, N. Y.

(Pipe: See also Clay, Concrete)

PLANNERS, AMERICAN INSTITUTE OF, Suite 410, 2400 16th St., N.W., Washington 9, D. C.

PLANNING AND DEVELOPMENT AGENCIES, ASSN. OF STATE, 1026 17th St., N.W., Washington 6, D. C.

PLANNING OFFICIALS, AMERICAN SOCIETY OF, 1313 E. 60th St., Chicago 37, Ill.

PLANT ADMINISTRATORS OF UNIVERSITIES AND COLLEGES, NATL. ASSN. OF PHYSICAL, Mass. Institute of Technology, Cambridge, Mass.

PLANT ENGINEERS, AMERICAN INSTITUTE OF, P.O. Box 185, Barrington, Ill.

PLASTERERS' & LATHERS' INTL. ASSN., CONTRACTING, 711 14th St., N.W., Washington 5, D. C.

PLASTIC FABRICATORS, NATL. ASSN. OF, 812 Engineers Bldg., Cleveland 14, Ohio

PLASTICS ENGINEERS, INC., SOCIETY OF, 65 Prospect St., Stamford, Conn.

PLASTICS INDUSTRY, INC., SOCIETY OF THE, 250 Park Ave., New York 17, N. Y.

PLATE FABRICATORS ASSN., STEEL, 105 W. Madison St., Chicago 2, Ill.

PLUMBING AND DRAINAGE INSTITUTE, Rm. 814, 20 N. Wacker Dr., Chicago 6, Ill.

PLUMBING BRASS INSTITUTE, Suite 759, 1 Gateway Center, Pittsburgh 22, Pa.

PLUMBING CONTRACTORS, NATL. ASSN. OF, 1016 20th St., N.W., Washington 6, D. C.

PLUMBING FIXTURE MANUFACTURERS ASSN., 1145 19th St., N.W., Washington 6, D. C.

PLUMBING-HEATING-COOLING INFORMATION BUREAU, 35 E. Wacker Dr., Chicago 1, Ill.

PLYWOOD ASSN., DOUGLAS FIR, 1119 A St. Tacoma 2, Wash.

PLYWOOD RESEARCH FOUNDATION, 620 E. 26th St., Tacoma 4, Wash.

PORCELAIN ENAMEL INSTITUTE, INC., 1145 19th St., N.W., Washington 6, D. C.

PORTLAND CEMENT ASSN., 33 W. Grand Ave., Chicago 10, Ill.

PRODUCERS' COUNCIL, INC., 2029 K St., N.W., Washington 6, D. C.

PROPERTY OWNERS ASSN. OF AMERICA, INC., Rialto Bldg., Kansas City 6, Mo.

PUBLIC HEALTH ASSN., AMERICAN, 1790 Broadway, New York 19, N.Y.

PUBLIC HEALTH ENGINEERS, CONFERENCE OF MUNICIPAL, School of Public Health, Univ. of Michigan, Ann Arbor, Mich.

PUBLIC WORKS ASSN., AMERICAN, 1313 E. 60th St., Chicago 37, Ill.

PULP & PAPER INDUSTRY, TECHNICAL ASSN. OF THE, 155 E. 44th St., New York 17, N. Y.

PULP PRODUCERS ASSN., INC., U.S., 122 E. 42nd St., New York 17, N. Y.

PUMP BUREAU, CONTRACTORS', 20th & E Sts., N.W., AGC Bldg., Washington 6, D. C.

PUMP MANUFACTURERS, NATL. ASSN. OF DOMESTIC AND FARM, 1028 Connecticut Ave., N.W., Rm. 614A, Washington 6, D. C.

## R

RAIL STEEL BAR ASSN., 38 S. Dearborn St., Chicago 3, Ill.

RAILWAY BRIDGE AND BUILDING ASSN., AMERICAN, 431 S. Dearborn St., Chicago 5, Ill.

REAL ESTATE APPRAISERS, AMERICAN INSTITUTE OF, 36 S. Wabash Ave., Chicago 3, Ill.

REAL ESTATE BOARDS, NATL. ASSN. OF, 36 S. Wabash Ave., Chicago 3, Ill.

REAL ESTATE BROKERS, NATL. INSTITUTE OF, 36 S. Wabash Ave., Chicago 3, Ill.

REAL ESTATE MANAGEMENT, INSTITUTE OF (of NAREB), 36 S. Wabash Ave., Chicago 3, Ill.

REALTORS, SOCIETY OF INDUSTRIAL, 1309 Connecticut Ave., N.W., Suite 204, Washington 6, D. C.

REDWOOD ASSN., CALIFORNIA, 576 Sacramento St., San Francisco 11, Calif.

REFRIGERATING ENGINEERS, NATL. ASSN. OF PRACTICAL, 435 N. Waller Ave., Chicago 44, Ill.

(Refrigerating: See also Heating, Air Cond.)

REFRIGERATION AND AIR CONDITIONING CONTRACTORS ASSN., 1028 Connecticut Ave., N.W., Washington 6, D. C.

REFRIGERATION SERVICE ENGINEERS SOCIETY, 435 N. Waller Ave., Chicago 44, Ill.

REFRIGERATOR MANUFACTURERS ASSN., COMMERCIAL, 111 W. Washington St., Chicago 2, Ill.

REFRIGERATOR SALES ASSN., NATL. COMMERCIAL, 1900 Arch St., Philadelphia 3, Pa.

RESIDENTIAL APPRAISERS, SOCIETY OF, 7 S. Dearborn St., Chicago 3, Ill.

RLM STANDARDS INSTITUTE, INC., 326 W. Madison St., Chicago 6, Ill.

ROOFING AND SHEET METAL CRAFTS INSTITUTE, 60 E. 42nd St., New York 17, N. Y.

ROOFING CONTRACTORS ASSN., NATL., 189 W. Madison St., Chicago 2, Ill.

ROOFING, SIDING & INSULATING CONTRACTORS ASSN., NATL. ESTABLISHED (Nersica, Inc.), 12 E. 41st St., New York 17, N. Y.

## S

SAFETY COUNCIL, NATL., 425 N. Michigan Ave., Chicago 11, Ill.

SAND AND GRAVEL ASSN., NATL., 1411 K St., N.W., Washington 5, D. C.

SANITARY ENGINEERING, AMERICAN SOCIETY OF, 228 Standard Bldg., Cleveland 13, Ohio.

SANITARY ENGINEERS, CONFERENCE OF STATE, New Jersey State Dept. of Health, Trenton 7, N. J.

SANITARY SUPPLY ASSN., NATL., 159 N. Dearborn St., Chicago 1, Ill.

SANITATION FOUNDATION, NATL., School of Public Health, Univ. of Michigan, Ann Arbor, Mich.

SANITATION MANAGEMENT, INSTITUTE OF, c/o Eastman Kodak Co., Kodak Park Works, 1669 Lake Ave., Rochester 4, N.Y.

(Sanitation: See also Hygiene, Sewage, Water)

SASH & DOOR JOBBERS ASSN., NORTHERN, 11 S. LaSalle St., Chicago 2, Ill.

SASH & DOOR JOBBERS ASSN., SOUTHERN, 330 Joyner-Rembert Bldg., 3340 Poplar Ave., Memphis 11, Tenn.

SAVINGS & LOAN INSTITUTE, AMERICAN, 221 N. LaSalle St., Chicago 1, Ill.

SAVINGS & LOAN LEAGUE, U. S., 221 N. LaSalle St., Chicago 1, Ill.

SAVINGS ASSNS., NATL. LEAGUE OF INSURED, 907 Ring Bldg., 18th & M Sts., N.W., Washington 6, D. C.

SCHOOL BUSINESS OFFICIALS OF THE U. S. & CANADA, ASSN. OF, 1010 Church St., Evanston, Ill.

SCHOOLHOUSE CONSTRUCTION, NATL. COUNCIL ON, George Peabody College for Teachers, Nashville 4, Tenn.

SCREEN MANUFACTURERS ASSN., 110 N. Wacker Dr., Chicago 6, Ill.

SCREENING BUREAU, INSECT WIRE, 630 3rd Ave., New York 17, N. Y.

SCREW RESEARCH ASSN., 161 Prescott St., East Boston 28, Mass.

SCREW SERVICE BUREAU, U. S. WOOD, 53 Park Pl., New York 7, N. Y.

SERVICE TOOLS INSTITUTE, 53 Park Pl., New York 7, N. Y.

SHALE, CLAY & SLATE INSTITUTE, EXPANDED, Natl. Press Bldg., Washington 4, D. C.

SHEET METAL AND AIR CONDITIONING CONTRACTORS', INC., NATL. ASSN. OF, 107 Center St., Elgin, Ill.

SHINGLE BUREAU, RED CEDAR, 5510 White Bldg., Seattle 1, Wash.

SHINGLE INDUSTRY, U. S. RED CEDAR, White-Henry-Stuart Bldg., Seattle 1, Wash.

SHOPPING CENTERS, INTL. COUNCIL OF, 54 Park Ave., New York 16, N. Y.

SIDING ASSN., ALUMINUM, Tribune Tower, Chicago, Ill.

SILO ASSN., NATL., Box 30, Norwich, N. Y.

SLAG ASSN., NATL., 613 Perpetual Bldg., Washington 4, D. C.

SLAG ASSN., PENNSYLVANIA, 1600 Frick Annex Bldg., 429 Forbes Ave., Pittsburgh 19, Pa.

SLATE ASSN., NATL., 455 W. 23rd St., New York 11, N. Y.

SOLAR ENERGY, ASSN. FOR APPLIED, % Arizona State Univ., Tempe, Ariz.

SPECIFICATION INSTITUTE, AMERICAN, 134 N. LaSalle St., Chicago 2, Ill.

SPECIFICATIONS INSTITUTE, THE CONSTRUCTION, 632 Dupont Circle Bldg., Washington 6, D. C.

SPRINKLER AND FIRE CONTROL ASSN., INC., NATL. AUTOMATIC, 60 E. 42nd St., New York 17, N. Y.

SPRINKLER IRRIGATION ASSN., 1028 Connecticut Ave., N.W., Washington 6, D. C.

STANDARDS ASSN., AMERICAN, 10 E. 40th St., New York 16, N. Y.

STANDARDS ENGINEERS SOCIETY, 1025 Connecticut Ave., N.W., Washington 6, D. C.

STAPLE & STAPLING MACHINE MANUFACTURERS ASSN., 631 3rd Ave., New York 17, N. Y.

STEEL CONSTRUCTION, INC., AMERICAN INSTITUTE OF, 101 Park Ave., New York 17, N. Y.

STEEL DISTRIBUTORS, INC., ASSN. OF, 29 Broadway, New York 6, N. Y.

STEEL JOIST INSTITUTE, Dupont Circle Bldg., 1346 Connecticut Ave., N.W., Washington 6, D. C.

STEEL WAREHOUSE ASSN., AMERICAN, 540 Terminal Tower, Cleveland 13, Ohio.

STOKER MANUFACTURERS ASSN., 307 N. Michigan Ave., Chicago 1, Ill.

STONE ASSN., NATL. CRUSHED, 1415 Elliot Pl., N.W., Washington 7, D. C.

STONE INSTITUTE, BUILDING, 420 Lexington Ave., New York 17, N. Y.

STRUCTURAL JOINTS, RESEARCH COUNCIL ON RIVETED & BOLTED, % Dr. H. K. Work, Dir., Engineering Foundation, 29 W. 39th St., New York 18, N. Y.

STUCCO MANUFACTURERS ASSN., INC., 347 N. Central Ave., Glendale 3, Calif.

SUPPLY ASSNS., INC., AMERICAN INSTITUTE OF, 1628 Rhode Island Ave., N.W., Washington 6, D. C.

SURETY ASSN. OF AMERICA, 60 John St., New York 38, N. Y.

SURETY BOND PRODUCERS, NATL. ASSN. OF, 330 Third Natl. Bank Bldg., Nashville 3, Tenn.

SURVEYORS INSTITUTE, CONSTRUCTION, 101 Park Ave., New York 17, N. Y.

SWIMMING POOL INSTITUTE, NATL., Harvard, Ill.

## T

TAPE COUNCIL, PRESSURE SENSITIVE, Box 103, 1201 Waukegan Rd., Glenview, Ill.

TERRA COTTA INSTITUTE, ARCHITECTURAL, 1520 18th St., N.W., Washington 6, D. C.

TERRAZZO & MOSAIC ASSN., INC., NATL., Rm. 404, Sheraton Bldg., 711 14th St., N.W., Washington 5, D. C.

TESTING MATERIALS, AMERICAN SOCIETY FOR, 1916 Race St., Philadelphia 3, Pa.

TILE ASSN., THE AMERICAN, Rm. 3608, Guardian Bldg., Detroit 26, Mich.

TILE CONTRACTORS ASSN. OF AMERICA, 1420 New York Ave., N.W., Washington 5, D. C.

TILE COUNCIL OF AMERICA, INC., 800 2nd Ave., New York 17, N. Y.

TILE INSTITUTE, FACING, 1520 18th St., N.W., Washington 6, D. C.

TILE MANUFACTURERS ASSN., 1604 K St., N.W., Washington 6, D. C.

TIMBER CONSTRUCTION, AMERICAN INSTITUTE OF, 1757 K St., N.W., Washington 6, D. C.

(Timber: See also Forest, Lumber, Wood)

TOOL MANUFACTURERS INSTITUTE, POWDER ACTUATED, 250 E. 43rd St., New York 17, N. Y.

TRAILER COACH ASSN., 607 S. Hobart Blvd., Los Angeles 5, Calif.

(Turnpike, Tunnel: See Bridge)

TWISTED JUTE PACKING & OAKUM INSTITUTE, 19 W. 44th St., New York 36, N. Y.

## U

UNDERWRITERS, AMERICAN INSTITUTE FOR PROPERTY & LIABILITY, 3924 Walnut St., Philadelphia, Pa.

UNDERWRITERS' LABORATORIES, INC., 207 E. Ohio St., Chicago 11, Ill.

UPHOLSTERY & DRAPERY FABRIC MANUFACTURERS ASSN., INC., 500 5th Ave., New York 36, N. Y.

URBAN LAND INSTITUTE, 1200 18th St., N.W., Washington 6, D. C.

## V

VALVE & FITTINGS INDUSTRY, MANUFACTURERS STANDARDIZATION SOCIETY OF THE, 420 Lexington Ave., New York 17, N. Y.

VENETIAN & VERTICAL BLIND ASSN. OF AMERICA, 2217 Tribune Tower, Chicago 11, Ill.

VENTILATING INSTITUTE, INC., HOME, 19 W. 44th St., New York 36, N. Y.

VENTILATOR INSTITUTE, METAL, 22 W. Monroe St., Chicago 3, Ill.

VERMICULITE ASSN., INC., 64-67 83rd Pl., Rego Park, N. Y.

VERMICULITE INSTITUTE, 208 S. LaSalle St., Chicago 4, Ill.

VINYL FABRICS INSTITUTE, 65 E. 55th St., New York 22, N. Y.

#### W

WALLCOVERING WHOLESALERS ASSN., 808 Land Title Bldg., Philadelphia 10, Pa.

WALLPAPER INSTITUTE, 509 Madison Ave., New York 22, N. Y.

WALNUT MANUFACTURERS' ASSN., AMERICAN, Rm. 1729, 666 N. Lake Shore Dr., Chicago 11, Ill.

WATER & SEWAGE WORKS MANUFACTURERS ASSN., INC., 165 Broadway, New York 6, N. Y.

(Water: See also Hygiene, Sanitation)

WATER CONDITIONING FOUNDATION, Box 103, 1201 Waukegan Rd., Glenview, Ill.

WATER CONDITIONING INSTITUTE, INDUSTRIAL, P.O. Box 560, Rockford, Ill.

WATER POLLUTION CONTROL FEDERATION, 4435 Wisconsin Ave., N.W., Washington 16, D. C.

WATER TANK MANUFACTURERS COUNCIL, DOMESTIC, 55 Liberty St., New York 5, N. Y.

WATER WELL ASSN., NATL., Box 222, Urbana, Ill.

WATER WORKS ASSN., THE AMERICAN, 2 Park Ave., New York 16, N. Y.

WATERPROOFERS ASSN., P.O. Box 32, Poughkeepsie, N. Y.

WATERPROOFERS ASSN., INC., BUILDING, 60 E. 42nd St., New York 17, N. Y.

WEATHERSTRIP RESEARCH INSTITUTE, Box 128, Riverside, Ill.

WINDOW & DOOR INSTITUTE, NATL., COMBINATION STORM, 280 Madison Ave., New York 16, N. Y.

WINDOW INSTITUTE, STEEL, 806 Rowland Rd., Cheltenham, Pa.

WINDOW MANUFACTURERS ASSN., ALUMINUM, 630 3rd Ave., New York 17, N. Y.

(Window: See also Door)

WIRE ASSN., THE, 453 Main St., Stamford, Conn.

WIRE REINFORCEMENT INSTITUTE, INC., Natl. Press Bldg., Washington 4, D. C.

WIRING BUREAU, NATL., 155 E. 44th St., New York 17, N. Y.

WOOD ENGINEERING, AMERICAN INSTITUTE OF, U. S. Forest Products Laboratory, Madison 5, Wis.

WOOD PRESERVERS' ASSN., AMERICAN, 839 17th St., N.W., Washington 6, D. C.

WOOD PRESERVERS INSTITUTE, AMERICAN, 111 W. Washington St., Chicago 2, Ill.

WOOD PRESERVERS INSTITUTE, VACUUM, 5151 Holmes Rd., Houston, Texas.

WOOD-TURNERS SERVICE BUREAU, 20 Providence St., Boston 16, Mass.

WOODS INSTITUTE, DURABLE, 576 Sacramento St., San Francisco 11, Calif.



WOODWORK ASSN., SOUTHERN, P.O.  
Box 1804, Knoxville, Tenn.

WOODWORK INSTITUTE, ARCHITECTURAL, 332 S. Michigan Ave., Chicago 4, Ill.

WOODWORK MANUFACTURERS ASSN., INC., NATL., 332 S. Michigan Ave., Chicago 4, Ill.

WOODWORKING MACHINERY MANUFACTURERS ASSN., 1900 Arch St., Philadelphia 3, Pa.

WRITERS ASSN., CONSTRUCTION, 202 Homer Bldg., Washington 5, D. C.

# Z

ZINC INSTITUTE, INC., AMERICAN, 292 Madison Ave., New York 17, N. Y.

## APPENDIX 3-4 SIMPLIFIED PRACTICE RECOMMENDATIONS CONCERNING THE CONSTRUCTION INDUSTRY

SOURCE: Classified List of Simplified Practice Recommendations, Revised October 1, 1959, Commodity Standards Division.

"M" indicates that printed copies are no longer available but mimeographed copies are supplied in limited numbers by Commodity Standards Division.

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for the prices listed.

### BUILDING MATERIALS

<i>SPR No.</i>	<i>Title</i>	<i>Price</i>
3-47	Metal lath (expanded and sheet) and metal plastering accessories .....	10¢
16-53	Lumber (American Lumber Standards for softwood lumber) .....	15¢
26-50	Steel reinforcing bars .....	5¢
29-51	Eaves trough, conductor pipe and fittings (under revision) .....	M
61-44	Clay tiles for floors and walls (under revision) .....	M
78-50	Iron and steel roofing, siding and ridge roll .....	5¢
157-50	Steel firebox boilers and steel heating boilers (commercial and residential types) .....	M
179-56	Structural insulating board (wood or other vegetable fiber) .....	M
180-41	Copper conductors for building purposes .....	M
183-46	Brass or bronze valves (gate, globe, angle and check) .....	5¢
207-56	Pipes, ducts and fittings for warm-air heating and air-conditioning systems (under revision) .....	M
211-45	Clay sewer pipe and fittings .....	M
213-45	Asphalt-roll-roofing and asphalt and tar-saturated-felt products .....	5¢
225-56	Asphalt tile .....	5¢
235-48	Copper and copper-alloy round seamless tube .....	5¢
238-50	Convectors .....	5¢

<i>SPR No.</i>	<i>Title</i>	<i>Price</i>
241-50	Copper and copper-alloy rod .....	5¢
243-51	Unorificed radiator supply valves .....	5¢
256-55	Steel outlet boxes (zinc or cadmium-coated) .....	20¢
257-57	Thermal conductance-factors for performed above-deck roof installation .....	5¢
<b>FABRICS</b>		
199-42	Cloth window shades .....	5¢
<b>HARDWARE, IRON AND STEEL</b>		
9-47	Woven wire fencing and galvanized barbed wire .....	10¢
47-54	Small cut nails; and cut tacks .....	M
100-47	Welded chain .....	10¢
169-45	Bolts and nuts (stock production sizes) .....	M
190-42	Stove pipe and accessories .....	5¢
198-50	Wire rope .....	10¢
216-46	Hot-rolled carbon steel structural shapes .....	10¢
221-46	Steel rivets .....	5¢
222-46	Hot-rolled carbon steel bars and bar-size shapes .....	M
223-47	Wire nails and staples .....	10¢
234-48	Welded wire fabric reinforcement for concrete pipe .....	M
245-51	Weldless chain and chain products .....	10¢
<b>HEATING, VENTILATING, AND REFRIGERATION</b>		
8-50	Range boilers, expansion and solar tanks .....	M
157-50	Steel firebox boilers and steel heating boilers (commercial and residential) .....	M
207-50	Pipes, ducts and fittings for warm-air heating and air-conditioning systems (under revision) .....	M
235-48	Copper and copper-alloy round seamless tube .....	5¢
238-48	Convectors .....	5¢
243-51	Unorificed radiator supply valves .....	5¢
244-51	Low pressure thermostatic radiator traps and float- and thermostatic traps .....	M
<b>PLUMBING MATERIALS, PIPE AND FITTINGS</b>		
204-44	Bronze safety pop valves .....	5¢
205-44	Iron and steel relief valves (for petroleum, chemical and general industrial services) .....	5¢
207-56	Pipes, ducts and fittings for warm-air heating and air-conditioning systems (under revision) .....	M
211-45	Clay sewer pipe and fittings .....	M
212-45	Cast brass solder joint fittings .....	M
217-49	Copper water tube and copper and brass pipe .....	M

<i>SPR No.</i>	<i>Title</i>	<i>Price</i>
219-46	Automatic regulating valves .....	5¢
235-48	Copper and copper-alloy round seamless tube .....	5¢

### APPENDIX 3-5 COMMERCIAL STANDARDS CONCERNING THE CONSTRUCTION INDUSTRY

SOURCE: Classified List of Commercial Standards, Revised July 1, 1959, Commodity Standards Division.

"T" indicates that copies are temporarily unavailable.

"M" indicates that printed copies are no longer available but mimeographed copies are supplied in limited numbers by Commodity Standards Division.

"OP" indicates that copies are not available.

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for the prices listed.

#### BUILDING MATERIALS

<i>CS No.</i>	<i>Title</i>	<i>Price</i>
211-57	Flush type interior steel doors and frames .....	10¢
212-57	Steel sliding door and frame units .....	10¢
213-57	Steel knockdown sliding closet door units (for wood frame installation) .....	10¢

#### CERAMIC, MINERAL, AND VITREOUS MATERIALS

4-29	Staple porcelain (all-clay) plumbing fixtures .....	M
20-56	Vitreous china plumbing fixtures (sixth edition) .....	15¢
23-30	Feldspar .....	M
27-36	Mirrors (second edition) .....	10¢
181-52	Water-resistant organic adhesives for installation of clay tile ..	10¢

#### CHEMICALS

152-48	Copper naphthenate wood-preservative .....	M
165-50	Zinc naphthenate wood-preservative .....	5¢
194-53	Pentachlorophenol concentrate for wood preservation and soil poisoning .....	M

#### COLORS AND COLOR MATERIALS

62-38	Colors for kitchen accessories .....	5¢
63-38	Colors for bathroom accessories .....	M
98-42	Artists' oil paints (amended 1952) .....	M
130-46	Color materials for art education in schools (under revision) ..	M
147-47	Colors for molded urea plastics .....	5¢
156-49	Colors for polystyrene plastics (amended 1952) .....	5¢

## ELECTRICAL AND MECHANICAL EQUIPMENT

<i>CS No.</i>	<i>Title</i>	<i>Price</i>
126-56	Tank-mounted air compressors (second edition) . . . . .	10¢
127-45	Self-contained mechanically refrigerated drinking water coolers . . . . .	OP
142-58	Automotive lifts (third edition) . . . . .	15¢
167-50	Automotive and general service copper tube . . . . .	5¢
178-51	Testing and rating ventilating fans (axial and propeller types) (amended 1956) . . . . .	10¢
179-51	Installation of attic ventilation fans in residences . . . . .	10¢
202-56	Industrial lifts and hinged loading ramps . . . . .	10¢

## HARDWARE, INSTRUMENTS, AND TOOLS

9-33	Builders' template hardware (second edition) . . . . .	OP
132-46	Hardware cloth . . . . .	5¢
133-46	Woven wire netting . . . . .	5¢
138-55	Insect wire screening (third edition) (amended 1956) . . . . .	10¢
184-51	Steel fence posts—field and line type (produced from hot-rolled steel sections) . . . . .	5¢

## HEATING, VENTILATING, AND REFRIGERATION

(See also "THERMAL INSULATION")

5-46	Pipe nipples; brass, copper, steel and wrought iron (second edition) . . . . .	OP
7-29	Standard weight malleable iron or steel screwed unions . . . . .	5¢
48-40	Domestic burners for Pennsylvania anthracite . . . . .	10¢
75-56	Automatic mechanical-draft oil burners designed for domestic installations (third edition) . . . . .	15¢
101-43	Flue-connected oil-burning space heaters equipped with vapor- izing pot-type oil burners (under revision) . . . . .	OP
104-49	Warm-air furnaces equipped with vaporizing type oil burners (third edition) (under revision) . . . . .	OP
109-44	Solid-fuel-burning forced-air furnaces . . . . .	10¢
113-51	Oil-burning floor furnaces equipped with vaporizing pot-type burners (second edition) (under revision) . . . . .	10¢
115-44	Porcelain-enameled tanks for domestic use (under revision) . . . . .	M
127-45	Self-contained mechanically refrigerated drinking water coolers . . . . .	OP
140-47	Testing and rating convectors (under revision) . . . . .	OP
145-47	Testing and rating of hand-fired hot-water-supply boilers . . . . .	10¢
178-51	Testing and rating ventilating fans (axial and propeller type) (amended 1956) . . . . .	10¢
179-51	Installation of attic ventilation fans in residences . . . . .	10¢
195-57	Warm-air furnaces equipped with pressure-atomizing or rotary- type oil burners (amended 1958) (under revision) . . . . .	15¢

## LUMBER AND WOOD PRODUCTS

<i>CS No.</i>	<i>Title</i>	<i>Price</i>
31-52	Wood shingles (red cedar, tidewater red cypress, California redwood) (fifth edition) .....	10¢
35-56	Hardwood plywood (fifth edition) .....	15¢
42-49	Structural fiber insulating board (fourth edition) .....	10¢
45-55	Douglas fir plywood (ninth edition) (amended 1959) .....	15¢
56-49	Oak flooring (third edition) (under revision) .....	10¢
60-48	Hardwood dimension lumber (second edition) .....	10¢
61-51	Venetian blinds (Grade A, custom-made) (second edition) ..	10¢
64-37	Walnut veneers .....	M
74-39	Solid hardwood wall paneling .....	M
92-41	Cedar, cypress and redwood tank-stock lumber .....	M
112-43	Homogeneous fiber wallboard .....	M
122-56	Western softwood plywood (third edition) .....	15¢
125-47	Prefabricated homes (second edition) .....	15¢
157-56	Pine plywood (ponderosa pine, sugar pine, Idaho white pine) (second edition) .....	10¢
160-49	Wood-fiber blanket insulation (for building construction) ....	10¢
176-58	Prefinished hardboard wall panels .....	10¢
199-55	Machine-grooved shakes and rebuted-rejointed shingles .....	10¢

## MILLWORK

73-51	Old growth Douglas fir, Sitka spruce and Western hemlock standard stock doors (fifth edition) (under revision) .....	15¢
76-39	Hardwood interior trim and molding .....	M
89-40	Hardwood stair treads and risers .....	5¢
91-41	Factory-fitted Douglas fir entrance doors .....	5¢
120-58	Ponderosa pine doors (fifth edition) .....	30¢
163-59	Standard stock ponderosa pine windows, sash, and screens (third edition) .....	20¢
171-58	Hardwood veneered doors (solid-core, hollow-core, and panel and sash) (Supersedes CS200-55 also) .....	20¢
190-59	Standard stock double-hung wood window units .....	15¢
193-53	Standard stock ponderosa pine insulating glass windows and sash .....	10¢
204-59	Standard stock wood awning window units, and projected-awning and stationary sash units .....	15¢
205-59	Standard stock wood casement window units .....	15¢
208-57	Standard stock wood door and window frames .....	15¢

## PLASTICS

147-47	Colors for molded urea plastics .....	5¢
156-49	Colors for polystyrene plastics (amended 1952) .....	5¢
168-50	Polystyrene plastic wall tiles and adhesives for their application	10¢

<i>CS No.</i>	<i>Title</i>	<i>Price</i>
192-53	General-purpose vinyl plastic film (amended #1, 1954, amended #2, 1954) .....	10¢
201-55	Rigid polyvinyl chloride sheets .....	10¢
214-57	Glass-fiber reinforced polyester corrugated structural plastics panels .....	10¢

#### PLUMBING MATERIALS AND FIXTURES, PIPE AND FITTINGS

4-29	Staple porcelain (all-clay) plumbing fixtures .....	M
5-46	Pipe nipples; brass, copper, steel, and wrought iron (second ed.)	OP
7-29	Standard weight malleable iron or steel screwed unions .....	5¢
20-56	Vitreous china plumbing fixtures (sixth edition) .....	15¢
29-31	Staple seats for water closet bowls .....	M
77-56	Enameled cast iron plumbing fixtures (fourth edition) .....	15¢
94-41	Calking lead .....	M
95-41	Lead pipe .....	M
96-41	Lead traps and bends .....	M
111-43	Earthenware (vitreous-glazed) plumbing fixtures .....	5¢
115-44	Porcelain-enameled tanks for domestic use (under revision) ..	M
116-54	Bituminized-fibre drain and sewer pipe (second edition) .....	10¢
143-59	Standard strength and extra strength perforated clay pipe ....	T
144-47	Formed metal porcelain-enameled sanitary ware .....	M
145-47	Testing and rating of hand-fired hot-water-supply boilers .....	10¢
172-50	Brass trim for water-closet bowls, tanks and urinals (dimensional standards) .....	10¢
177-51	Bituminous-coated metal septic tanks (single compartment, residential) (1957 amendment) (under revision) .....	T
188-59	Service-weight cast-iron soil pipe and fittings .....	30¢
197-59	Flexible polyethylene plastic pipe (under revision) .....	10¢
206-57	Dimensions and tolerances for solvent welded (SWP size) cellulose-acetate butyrate pipe .....	5¢
207-57	Dimensions and tolerances for rigid polyvinyl chloride pipe (under revision) .....	5¢
221-59	Gel-coated glass-fiber-reinforced polyester resin bathtubs ....	10¢
222-59	Gel-coated glass-fiber-reinforced polyester resin shower receptors .....	10¢
224-59	Vitrified clay sewer pipe (standard and extra strength) .....	T
226-59	Laminated-wall, bituminized-fiber drain and sewer pipe .....	T

#### THERMAL INSULATION MATERIALS

42-49	Structural fiber insulating board (fourth edition) .....	10¢
105-48	Mineral wool insulation for low temperatures (second edition)	OP
117-49	Mineral wool insulation for heated industrial equipment (second edition) .....	15¢
131-46	Industrial mineral wood products, all types, testing and reporting	15¢
160-49	Wood-fiber blanket insulation (for building construction) ....	10¢
216-58	Asphalt insulating siding .....	10¢

## CHAPTER 4

### Specification Sections

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#### 4-1 GENERAL

- a. A set of specifications is composed of words grouped into sentences, the sentences arranged in paragraphs and the paragraphs, in turn, separated into chapters as in a book, except that *chapters* in specifications are called *sections*. In well-prepared specifications an attempt is made to have the paragraphs in each section apply to one trade, to one classification of material, or to all the work customarily handled by one subcontractor; this is done to assist the General Contractor in his preparation of bids and awarding of subcontracts.
- b. Some specification writers designate their chapters as divisions, but naming them *sections* seems simpler, reserving the word *division* for the designation of groups of sections where this may be necessary; thus a set of specifications might be separated into an Architectural Division and a Mechanical Division. Continuing our comparison with books, the word *division* would be similar to the word *volume*.

#### 4-2 SUPPLEMENTAL DOCUMENTS

- a. It is customary in specifications for large projects, and particularly for Government projects, to bind the supplemental documents at the beginning and thus make the set of specifications a more nearly complete record. Supplemental documents are discussed in Chapter 10, and the ones most often bound in with the specifications include:
  - A. Invitation to Bid (or Advertisement)
  - B. Instructions to Bidders
  - C. Bid Form
  - D. Form of Bid Bond
  - E. Contract Form
  - F. Form of Performance Bond
  - G. Form of Payment Bond
- b. Supplemental documents bound in with the specifications when required by a Government agency are:

## H. Non-Collusive Affidavit

## I. Statement of Bidder's Qualifications

- c. In some specifications the following are bound in as separate documents or sections but are more often made a part of the *Special Conditions* section:

## J. Wage Rates (as required for Government projects)

## K. General Scope of Work

## L. Schedule of Drawings

## 4-3 ARRANGEMENT OF SECTIONS

- a. The sections of a set of specifications should be arranged in a logical order. The customary sequence is based on an attempt to parallel the chronological development of the actual construction process.
- b. The sections seem to fall into related groups. Listed below is a suggested arrangement of section titles by groups, which may be used as a check list for specifications for large construction projects:
- c. *General*: General paragraphs applicable to all work of the entire construction job, or work to be performed by the General Contractor himself, are by custom put at the beginning of a set of specifications:

## 1. General Conditions

## 3. Special Conditions

## 2. Supplemental General Conditions

- d. *Work Prior to Construction*: Following the general sections should be the sections pertaining to work to be done prior to the usual construction. These sections include:

## 4. Demolition

## 7. Caissons

## 5. Earth Work

## 8.

## 6. Piling

## 9.

- e. *Concrete and Masonry*: Next in chronological order of work should be the sections on concrete and masonry, of which the foundations and exterior walls of most buildings are constructed. These sections include:

## 10. Concrete

## 16.

## 11. Concrete Form Work

## 17. Masonry

## 12. Concrete and Cement Finishes

## 18. Structural Glazed Units

## 19. Glass Block

## 13. Concrete Surface Coatings

## 20. Architectural Terra Cotta

## 14. Prestressed Concrete

## 21. Cut Stone Work

## 15. Precast Concrete

## 22.



- f. *Waterproofing, Dampproofing and Termite Protection.* Immediately following, or in conjunction with, concrete and masonry work there will probably be waterproofing and dampproofing work, and in sections of the country where required when wood framing is used, termite protection work. It is logical for these three sections to follow:

23. Waterproofing

25. Termite Protection

24. Dampproofing

- g. *Metal:* If the building for which the specifications are written is to be steel frame construction, the next section after dampproofing should be *Structural Steel*. It is advisable to follow this with all of the sections pertaining to metal work usually supplied by individual subcontractors. These sections include:

26. Reinforcing Steel

43. Special Metal Windows

27. Structural Steel

44.

28. Open Web Joists

45.

29. Miscellaneous Metals

46. Steel Doors

30. Cellular Steel Floors

47. Aluminum Doors

31. Metal Stairs

48. Vault Doors

32.

49. Rolling Metal Doors and Grilles

33.

50. Overhead Metal Doors

34. Metal Partitions

51. Revolving Metal Doors

35. Mesh Partitions

52. Special Metal Doors

36. Toilet Partitions

53.

37. Shower Partitions

54.

38. Special Metal Partitions

55. Ornamental Metal

39.

56. Store Front Equipment

40.

57. Window Walls

41. Steel Windows

58. Porcelain Enamel Panels

42. Aluminum Windows

59.

- h. *Wood and Hardware:* If the building for which the specifications are written is not of concrete or steel frame construction, it is probably of wood frame construction. In logical sequence, the section *Rough Carpentry* should follow metal work and, thereafter, other sections pertaining to wood work and the related section *Finish Hardware*. Thus, these sections will include:

60. Rough Carpentry

65. Overhead Wood Doors

61. Finish Carpentry

66.

62. Wood Stairs

67.

63. Wood Windows

68. Finish Hardware

64. Wood Doors

- i. *Roofing*: After a building has been framed the next step in construction is the roofing to put the building *in the dry*; therefore, the sections regarding roofing should follow:

69. Roof Decking	73. Metal Roofing and Siding
70. Roofing	74.
71. Sheet Metal Work	75.
72. Cement Asbestos Roofing and Siding	

- j. *Miscellaneous Work*: Sections covering architectural work not falling under a definite classification may be put into the specifications at this point. They include:

76. Thermal Insulation	80. Structural Glass
77. Weatherstripping	81. Stained Glass
78. Caulking	82.
79. Glass and Glazing	

- k. *Interior Finish*: Sections relating to the various interior finishes logically follow. These sections include:

83. Wood Flooring	93.
84. Wood Block Flooring	94. Interior Stone Work
85. Resilient Flooring	95. Terrazzo
86.	96. Ceramic Tile
87.	97. Accessories
88. Furring and Lathing	98.
89. Plastering (and Stucco)	99.
90. Dry Wall Construction	100. Acoustic Treatment
91. Wall Covering	101. Painting
92.	

- l. *Special Equipment* sections may be put in after the *Interior Finish* sections. They include:

102. Kitchen and Cafeteria Equipment	108. Shop Equipment
103. Cold Storage Rooms	109. Laboratory Equipment
104. Bakery Equipment	110. School Equipment
105. Chalkboards and Tack- boards	111. Gymnasium Equipment
106. Library Equipment	112. Bleachers
107. Home Economics Equip- ment	113. Stage Equipment
	114. Organs
	115. Hospital Equipment
	116. Casework

- |  |                              |
|--|------------------------------|
| 117. Sterilizers                         | 138. Auditorium Seating      |
| 118. Hospital Cubicles                   | 139. Church Furniture        |
| 119. X-Ray Equipment                     | 140. Court Room Furniture    |
| 120. X-Ray Protection                    | 141.                         |
| 121. Dark Room Equipment                 | 142. Built-In Furniture      |
| 122. Pharmacy Equipment                  | 143. Furniture               |
| 123. Mortuary Vaults                     | 144. Carpeting               |
| 124. Laundry Equipment                   | 145. Venetian Blinds         |
| 125. Filling Station Equipment           | 146. Shades                  |
| 126. Incinerators                        | 147. Draperies               |
| 127. Directory Boards                    | 148.                         |
| 128. Folding Partitions                  | 149. Signs and Letters       |
| 129. Metal Lockers                       | 150. Jalousies               |
| 130. Metal Shelving                      | 151. Sun Control Devices     |
| 131. Fire Fighting Equipment             | 152. Awnings                 |
| 132. Barber and Beauty Shop<br>Equipment | 153. Fire Escapes            |
| 133. Post Office Equipment               | 154. Radial Brick Chimney    |
| 134. Detention Equipment                 | 155. Playground Equipment    |
| 135. Vaults and Safes                    | 156. Swimming Pool Equipment |
| 136. Bank Equipment                      | 157. Flagpoles               |
| 137. Store Fixtures                      | 158.                         |

m. *Final Outside Work:* Last of the architectural sections should be sections regarding outside final work including:

- |                           |             |
|---------------------------|-------------|
| 159. Asphalt Paving       | 163. Fences |
| 160. Concrete Paving      | 164.        |
| 161. Paving Appurtenances | 165.        |
| 162. Lawns and Planting   |             |

n. *Conveyors:* Mechanical sections with reference to conveyors follow the architectural sections:

- |                          |                                   |
|--------------------------|-----------------------------------|
| 166. Passenger Elevators | 175. Package Chutes and Conveyors |
| 167. Freight Elevators   | 176. Rails and Hoists             |
| 168. Electric Stairways  | 177. Pneumatic Tube System        |
| 169. Dumb Waiters        | 178. Automobile Lifts             |
| 170. Ash Hoists          | 179. Window Washing Equipment     |
| 171. Dock Levelers       | 180.                              |
| 172. Truck Levelers      | 181.                              |
| 173. Mail Chutes         | 182.                              |
| 174. Linen Chutes        |                                   |

- o. *Plumbing*: After the mechanical sections with reference to conveyors it is customary to add the plumbing section and items of work related to plumbing:

183. Well and Pump	189.
184. Plumbing	190.
185. Sprinkler System	191.
186. Compressed Air System	192. Lawn Sprinkler System
187. Filtering System	193. Outside Utilities
188. Vacuum Cleaning System	194. Sewage Disposal

- p. *Heating*: After plumbing it is customary to add the heating section and items of work related to heating and other mechanical sections as follows:

195. Steam Generating Plant	200.
196. Heating	201.
197. Ventilating	202.
198. Air Conditioning	203. Outside Steam Distribution
199. Refrigeration	

- q. *Electrical*: It has been customary for years to end a set of specifications with the electrical section and related work:

204. Electrical	210. Operating Room Lights
205. Telephone System	211.
206. Call System	212.
207. Loud Speaker System	213.
208. Signalling System	214. Lightning Protection
209. Fire Alarm System	215. Outside Electrical Distribution

- r. The above 215 section titles given, including spares for future additions, can be used as a check list and also as a numerical filing system for specification information and for "cut-up sheets."

#### 4-4 SEPARATION OF SECTIONS

- a. When preparing specifications for intricate work, the specification writer should not attempt to consolidate his trade sections. It is far easier for the General Contractor to combine several sections into one subcontract than it is for him to separate the paragraphs of one section into two or more subcontracts.
- b. Having many individual sections also facilitates the reuse of sections prepared for previous work. It is easier to glance at a section title and know whether or not it is to be included than it is to extricate applicable paragraphs from a miscellaneous section.

#### 4-5 SPECIFICATIONS FOR SMALL JOBS

- a. Specification sections for a residence or other small job may be condensed into a few sections, since relatively few trades are involved and the General Contractor normally assumes a larger portion of the work himself. Often the Form of Contract and its General Conditions are bound in the front part of the specifications and the sections follow. The usual sequence of sections for residential specifications are:
- |   |                        |
|---|------------------------|
| 1. General Conditions                                     | 11. Plaster and Stucco |
| 2. Earth Work   | 12. Marble and Tile    |
| 3. Concrete   | 13. Flooring           |
| 4. Masonry  | 14. Painting           |
| 5. Waterproofing  | 15. Asphalt Paving     |
| 6. Miscellaneous Metal                                    | 16. Lawns and Planting |
| 7. Rough Carpentry  | 17. Plumbing           |
| 8. Finish Carpentry                                       | 18. Heating            |
| 9. Roofing and Sheet Metal                                | 19. Electrical         |
| 10. Weatherstripping, Insulation,<br>Caulking and Glazing |                        |
- b. These are the sections to be analyzed in Part II of this book beginning with Chapter 11.

## CHAPTER 5

# Specification Paragraphs

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### 5-1 PARAGRAPH

- a. The dictionary defines *paragraph* as a distinct subdivision of a discourse, chapter or writing, consisting of one or several sentences; a portion of writing which relates to a particular point and is generally distinguished typographically by a break in the lines.
- b. A section of architectural specifications is separated into paragraphs which should be as short as possible, arranged logically and titled, each dealing with a particular phase of the work delimited by that section. Some writers refer to these divisions as *clauses* or *articles* which are suitable, but the author prefers the term *paragraph* for reference to a subdivision of a specification section dealing with a particular item or procedure, as *Wood Shingles, Ceiling Boards, Door Frames, Wood Doors, Wood Stair and Hardware* (paragraph titles from a section on *Finish Carpentry*).

### 5-2 TYPES OF PARAGRAPHS

Paragraphs of a specification can be divided into two groups:

1. *General Paragraphs*, limiting and distinguishing related work or the work as a whole.
2. *Specific Paragraphs*, describing in detail each technical aspect of the work.

### 5-3 GENERAL PARAGRAPHS

- a. General paragraphs affecting the work in all sections or applying only to the General Contractor are usually grouped together and put in one section entitled *General Conditions* (and *Special Conditions*, if the job is large enough to warrant the two sections) at the beginning of a set of specifications. General paragraphs applying only to the work of one trade should be put at the beginning of the section covering work of the trade involved.

- b. The subject matter of these general paragraphs is placed under such headings as follow:

Delivery of Materials  
Storage of Materials  
Shop Drawings  
Samples  
Manufacture

Workmanship  
Requirements of Other Trades  
Permits  
Ordinances  
Guarantees

#### 5-4 SPECIFIC PARAGRAPHS

Specific paragraphs can be separated into approximately seven classification groups and should come after the General Paragraphs in the following sequence:

1. *Materials*: Paragraphs describing in detail material and items to be furnished and installed under the trade section, such as brick, cement, lumber and sheet metal.
2. *Combination of Materials*: Paragraphs giving the proportions for the combination of materials, such as concrete mixes or mortars.
3. *Preliminary Work Prior to Installation of Materials*: Paragraphs describing the preparation of surfaces to receive materials, such as the preparation of galvanized surfaces to receive paint; also the preparation of forms to receive concrete.
4. *Installation of Materials*: Paragraphs describing in detail the installation of materials, such as the laying of brick, pouring of concrete or laying floors.
5. *Tests*: Paragraphs designating the kind of tests which may be required, such as test of plumbing system, test of heating system, or load tests on concrete.
6. *Cleaning, Patching or Adjusting*: Paragraphs describing the final work to be done, such as cleaning masonry walls, patching plaster or adjusting heating system.
7. *Schedules*: Some schedules are included in the specification section and the logical place for them is at the end of the section: for example, hardware schedule or plumbing fixture schedule.

#### 5-5 GENERAL AND SPECIAL CONDITIONS PARAGRAPH

To remind each Subcontractor that his work is controlled by the *General Conditions* and *Special Conditions* sections, a paragraph similar to the following often is the first paragraph of each trade section:

"THE GENERAL CONDITIONS AND SPECIAL CONDITIONS, Sections 1 and 2, are hereby made a part of this section of the Specifications."

This paragraph is rarely used in sections of specifications describing small construction jobs, and many specification writers omit it from all specifications in an effort to keep the document from becoming too voluminous.

#### 5-6 SCOPE PARAGRAPH

- a. Some specification writers use a paragraph near the beginning of each section entitled *Scope*, *Scope of Work* or *Work Included*. The object of the paragraph is to state briefly the work covered by the section. The title of the section indicates what is to be expected, and the individual paragraphs themselves should cover the scope. It is obvious that the use of a *Scope* paragraph causes duplication, and therefore it is a dangerous practice. A Contractor might argue that an item described in the body of a specification section is not mentioned in the *Scope*, and therefore it is not required of him to furnish it under a contract covering the work described by the section.
- b. Here is a typical *Scope* paragraph:

"SCOPE: The work under this section of the specifications includes all labor, materials, equipment and services necessary for or reasonably incidental to the completion of all concrete work, as shown on the drawings or herein specified or both."

What does the above paragraph describe that is not implied by the section title *Concrete*? Nothing. It does not even mention reinforcing steel, form work, integral waterproofing and inserts which are actually described in the section from which the scope paragraph was lifted.

- c. On very large projects where there is a complicated interweaving of contracts, the use of *Scope* paragraphs may be of some value to define the limits of each Contractor's work, but even here it is doubtful.
- d. The only place a *Scope* paragraph seems to be of value is near the beginning of the *General Conditions* or *Special Conditions* section. Here this paragraph can make clear the overall extent of the project. By reading it a person will know immediately whether one or more buildings are to be constructed or whether the work is alterations or additions to an existing building or buildings, and for what purpose the building or buildings will serve. This information is not generally repeated anywhere else in the specifications and there is no danger of duplication. Example:

"SCOPE OF WORK: Contractor shall construct a residence on the Owner's property situated at 1625 Boulevard, Ennitown, Georgia, for Mr. & Mrs. Trad I. Tional, 1230 Piedmont Avenue, Ennitown, Georgia, in accordance with drawings and specifications prepared by M. O. Dern, Architect, 157 Cherry Street, Ennitown, Georgia."



- e. It is recommended that the *Scope* paragraph not be used except in the *General Conditions* section for the following reasons:
  - 1. Uses more words unnecessarily,
  - 2. Duplicates information,
  - 3. Makes contradiction more likely to occur.

#### 5-7 "WORK NOT INCLUDED" PARAGRAPH

- a. A *Work Not Included* paragraph near the beginning of a specification section would be more logical than the *Scope* or *Work Included* paragraph, but here again the work excluded in most cases can be covered better under another paragraph title, for example:

"WORK NOT INCLUDED under this heading consists of the furnishing of electrical fixtures which will be furnished by the Owner, but shall be installed by the Contractor."

- b. It would be better for the paragraph above to be written in its proper place in the specification section under a more appropriate title, as follows:

"ELECTRICAL FIXTURES will be furnished by the Owner and shall be installed by this Contractor."

- c. It is recommended that the *Work Not Included* paragraph be omitted except in the *General Conditions* section for the same reasons given regarding the *Scope* paragraph.

#### 5-8 TITLES FOR PARAGRAPHS

- a. Since it is not practical to cross-index a set of specifications, it is important that some means be employed for the quick identification of paragraphs. This can be done by giving each paragraph a title written in capital letters and underlined. To save repetition of words the title can often be made a part of the wording of the paragraph; for example:

"CONCRETE BRICK shall meet the requirements of ASTM Spec. C55 and shall be Grade A. Contractor has option of substituting concrete brick for common clay brick except in chimneys."

- b. For quick identification, reference may be facilitated by numbering the paragraphs in specifications covering large projects.

#### 5-9 PARAGRAPH SENTENCES

Paragraphs within a section of the specifications should be arranged in some logical order, and likewise the sentences within the paragraphs should

be arranged in some reasonable sequence. This might be accomplished by answering three questions regarding the subject: *Where? What? and How?* in the order mentioned; thus a paragraph regarding wall ties will read as follows:

"WALL TIES shall be used for anchoring masonry veneer to backup or to framing. Wall ties shall be crimped 22 gauge galvanized steel  $\frac{3}{4}$ " x 7" and shall be spaced not over 16" o.c. vertically and 32" o.c. horizontally."

#### 5-10 CONCLUSION

- a. This rather detailed discussion of the paragraphs may seem unimportant, but the quality of each paragraph and the interrelation of one with another determine the excellence of any specification.
- b. The building up of good principles and habits of writing specifications is of great importance. Not only must the specification writer interpret the drawings correctly and know materials and methods, but unless he describes them intelligibly and correlates them logically, the specifications may be more hindrance than help. Therefore, the next chapter will further break down the discussion to the words themselves which compose the paragraphs.

## CHAPTER 6

### Specification Language

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#### 6-1 GENERAL

The specification writer should present his instructions regarding construction work to be undertaken in such a manner that the drawings are more clearly interpreted and everyone's responsibility is designated without question. Specifications are read by contractors, construction superintendents, foremen and others connected with the building trades who should not be required to interpret subtle shades of meaning or stilted terms. The writer should use trade terms and clear language written in a simple manner. The aim of this chapter is to give a few pointers on how to achieve such a style.

#### 6-2 PHRASEOLOGY

In the development of early specifications stiffly formal terms and sentences were borrowed and have been recopied (many times without thought) throughout the years. Old-fashioned legal phraseology should be avoided in specifications, and clear technical language should be used instead.

#### 6-3 STREAMLINED SPECIFICATIONS

- a. A specification should be judged by its quality and not its length. The writer should always make an effort to reduce the verbiage used to describe methods and materials. This can be accomplished in many ways; several are suggested in this book.
- b. One authority proposes writing specifications in outline form without the use of complete sentences (see *Streamlined Specifications* by H. W. Peaselee, F.A.I.A., *Pencil Points*, August 1939). The outline form serves very well for materials, but it is difficult to adapt it to the description of methods, and therefore the author recommends the use of complete sentences throughout the specifications or at least for those portions where methods are described.

#### 6-4 SENTENCES

Sentences should be crisp, concise and short, written with simple words. If a sentence becomes too long and involved, it should be rewritten and made into two or more short sentences. It is more important to present facts clearly than it is to develop an elegant style of writing.

#### 6-5 PUNCTUATION

All sentences and clauses should be written carefully to permit punctuation marks to be added, eliminated or misplaced without changing the meaning. Use as few punctuation marks as possible, particularly commas.

#### 6-6 CAPITALIZATION

In specification writing follow the general rules regarding use of capitals for the first letter in words, and in addition capitalize the following:

1. Parties to the contract, including *Owner*, *Contractor* and *Architect*.
2. Spaces of the building, such as *Bed Room*, *Living Room* and *Office*.
3. The Contract documents, such as *Working Drawings*, *Specifications*, *General Conditions* and *Agreement* or *Contract*.
4. Grades of materials, such as *B* and *Better Southern Pine* and *Intermediate Heat Duty Fire Clay Brick*.

The use of capitals in these instances serves to clarify references in the body of the text.

#### 6-7 TENSE

- a. Although some authorities recommend the use of the same verb tense throughout a set of specifications, this may cause unnecessary wordiness and monotony.
- b. *Simple Imperative Mood*: The simple imperative mood may be substituted for the emphatic future tense to advantage, effecting an economy of words. For example:

"Contractor shall install lighting fixtures which will be furnished by Owner."

can be written:

"Install lighting fixtures which will be furnished by Owner."

- c. *Simple Present Infinitive*, likewise, may be substituted for the simple future tense; for example, the phrase above:

"Install lighting fixtures which will be furnished by Owner."

can be written:

"Install lighting fixtures to be furnished by Owner."

## 6-8 PRONOUNS

Minimize the use of pronouns. It is better to repeat the noun than risk possible misunderstanding.

## 6-9 WORDS AND PHRASES

a. Following is a list of words and phrases frequently misused in specification writing and should be particularly noted:

b. *Shall*: Use *shall* in connection with acts of the Contractor, or with labor, materials and equipment to be furnished by him.

*Poor*: "Contractor will install finish hardware."

"Footings will rest on undisturbed soil."

*Better*: "Contractor shall install finish hardware."

"Footings shall rest on undisturbed soil."

c. *Will*: Use *will* in connection with acts of the Owner or Architect.

*Poor*: "Lighting fixtures shall be furnished by Owner."

*Better*: "Lighting fixtures will be furnished by Owner."

d. *Must*: Avoid the use of *must* and *is to* and substitute the word *shall* to prevent the inference of different degrees of obligation.

e. *Any*: For the reason that *any* implies a choice, it should not be used when a choice is not intended, as for example:

*Poor*: "Any materials condemned or rejected shall be removed."

*Better*: "Materials condemned or rejected shall be removed."

f. *Either*: The word *both* should be substituted for *either* when no choice is intended.

*Poor*: "Glass panels shall be installed on either side of main entrance."

*Better*: "Glass panels shall be installed on both sides of main entrance."

g. *Of*: The preposition *of* often may be eliminated to shorten the text.

*Poor*: "For colors see Schedule of Paint Finishes."

*Better*: "For colors see Paint Finish Schedule."

*Poor*: "Apply one coat of stipple finish to walls in the Office of the Manager."

*Better*: "Apply one stipple finish coat to walls in Manager's Office."

h. *The*: Definite article *the* and indefinite articles *a* and *an* need not be used in many instances.

*Poor*: "Apply an oil paint with a brush to the walls."

*Better*: "Apply oil paint with brush to walls."

- i. *All*: The use of the word *all* is frequently unnecessary.  
*Poor*: "Store all millwork under shelter."  
*Better*: "Store millwork under shelter."
- j. *Which*: *Which* and other relative pronouns should be used sparingly, if at all.  
*Poor*: "Contractor shall install bathroom accessories which are to be purchased under an allowance."  
*Better*: "Contractor shall install bathroom accessories to be purchased under an allowance."
- k. *Same*: Do not use *same* as a pronoun.  
*Poor*: "If materials are rejected, the Contractor shall replace same at no additional cost."  
*Better*: "Contractor shall replace rejected materials at no additional cost."
- l. *Said*: Do not use *said* as an adjective.  
*Poor*: "Said materials shall be replaced at no additional cost."  
*Better*: "Rejected materials shall be replaced at no additional cost."
- m. *And/or*: This is a stilted legal expression. The word *or* or *both* should be used in place of *and/or*.  
*Poor*: "Brick shall be made of clay and/or shale."  
"Defects of workmanship and/or materials . . ."  
*Better*: "Brick shall be made of clay, shale or a combination of both."  
"Defects of workmanship or materials . . ."
- n. *Etc.*: Placed at the end of a list of items, *etc.* shows that the specification writer obviously does not know of what the complete list consists, or he is too lazy to write it out. The use of *etc.* is vague, throws unnecessary responsibility upon the Contractor, and therefore should not be used. As one specification writer puts it, "It is better to be definite even if you are wrong; then, at least, there is a firm basis for negotiating the corrections."
- o. *Contractor Shall*  
*Furnish and Install*: Since it is established by Article 3 of the A.I.A. Short Form of Contract recommended, there is no need for repeating in other sections the phrase, "Contractor shall furnish and install. . . ."
- p. *To the Satisfaction of the Architect*: "To the satisfaction of the Architect," "As the

Architect may direct," "Acceptable to the Architect," "In the opinion of the Architect," and similar phrases should be avoided. Instead, specify exactly what the Architect's directions are, or definitely what would be satisfactory or acceptable to him. Do not leave Contractor guessing and at the mercy of Architect's future decisions.

- q. *Or Equal*: *Or Equal, equal to, other approved equal, just as good* or similar expressions too often seen in specifications should not be used since the Contractor has no way of knowing what the Architect would consider equal to the brand specified. The architect might not agree with the Contractor's opinion of an *equal* product. Alternative is to specify two or more brands and allow Contractor the option of using any one.

*Poor*: "Insulating glass shall be equal to 'Thermopane' as manufactured by Libbey-Owens-Ford Glass Company."

*Better*: "Insulating glass shall be 'Thermopane' as manufactured by the Libbey-Owens-Ford Glass Company or 'Twindow' as manufactured by the Pittsburgh Plate Glass Company."

- r. *A Workmanlike Job*: "A workmanlike job," "a high-class job," "a first-class job," and similar phrases should not be employed; type of workmanship expected should be described in detail.

- s. *Numerals*: The practice of using numerals, rather than writing out the numbers throughout specifications, is recommended for the reason that numerals are used on the drawings and they make for clearer, easier reading. Numerals on the drawings, which are part of the contract documents, are considered legally binding and numerals in specifications are likewise legally binding.

*Poor*: "Four feet, six inches," "Twenty-six gauge"

*Better*: "4' 6"," "26 gauge"

- t. *Contractor*: It is considered better practice in specification writing not to use *Contractor* as the subject of a sentence. Instead make the *material* or the *method* the subject.

*Poor*: "Contractor shall lay brick in common bond."

*Better*: "Brick shall be laid in common bond."

- u. *Mechanical Contractor*: *The Mechanical Contractor, The Plumbing Contractor, The Heating Contractor, The Electrical Con-*

tractor, *The General Contractor*, and similar designations should be avoided. Instead the specifications should be written as if all the work is to be done by one construction firm. Of course, the Contractor always sublets some of the work and a great effort should be made to separate properly the requirements under appropriate trade sections to facilitate this. To name who is to do what robs the Contractor of his prerogative of distributing the work among Subcontractors as he sees fit.

v. *Comply with:*

When reference is made in a specification to a standard, it is better to state that the material *shall meet the requirements of* or *shall be in accordance with* than it *shall comply with* the standard.

*Poor:* "Structural steel shall comply with ASTM Spec. A7."

*Better:* "Structural steel shall meet the requirements of ASTM Spec. A7."

## 6-10 SIMPLIFIED SPELLING

Simplified spelling appears in some specifications, consisting mainly of: *Gage* for *Gauge*; *Molding* for *Moulding*; *Calk* for *Caulk*; and *Thru* for *Through*; a specification writer should select the spelling he prefers and be consistent.

## 6-11 ABBREVIATIONS

- a. There are many well-known and accepted abbreviations which may be used by a specification writer, without giving definitions. The use of abbreviations facilitates reading by Contractor and reduces the typing in a set of specifications without sacrificing clarity.
- b. Only abbreviations well known generally or to the building trades should be used. The following may be used with impunity:

c. *General Abbreviations*

ASTM	American Society for Testing Materials
bbl.	barrel
Co.	Company
Corp.	Corporation
cu.	cubic
Fed. Spec.	Federal Specification
ft.	foot, feet
gals.	gallons
hr.	hour



in.	inch, inches
Inc.	Incorporated
lb.	pound
lin.	linear
max.	maximum
min.	minimum
o.c.	on centers
oz.	ounce
sec.	second
sq.	square
wt.	weight

*d. Engineering Abbreviations*

ACI	American Concrete Institute
AISC	American Institute of Steel Construction
I.D.	inside diameter
psi	pounds per square inch
psf	pounds per square foot
rd.	round

*e. Lumber Abbreviations*

AD	air dried
Btr.	Better
Com.	Common
Dim.	Dimension
EM	end matched
J&P	joists and planks
KD	kiln dried
M	thousand
Mbm	thousand feet board measure
S1S	surfaced one side
S2S	surfaced two sides
S4S	surfaced four sides
T&G	tongued and grooved
V1S	V groove one side
V2S	V groove two sides

*f. Electrical Abbreviations*

amp.	ampere
kw.	kilowatt
hp	horse power
AC	alternating current
DC	direct current
NEC	National Electrical Code
AWG	American Wire Gauge

g. *Heating Abbreviations*

Btu	British thermal unit
Btuh	British thermal unit per hour
C.	degree Centigrade
F.	degree Fahrenheit
cfm	cubic feet per minute
fpm	feet per minute
gpm	gallons per minute
rpm	revolutions per minute
EDR	equivalent direct radiation
ASHR&ACE	American Society of Heating, Refrigerating and Air Conditioning Engineers

## 6-12 ESTIMATING UNITS

Although estimating units are not used extensively in architectural specifications, sometimes reference is made to them. The specification writer should employ the usual and accepted units of measure which are:

<i>Type of Work</i>	<i>Estimating Unit</i>
Clearing and grubbing	Acre
Excavation	Cubic yard
Piling	Linear foot
Fine Grading	Square yard
Pavement	Square yard
Sidewalks	Square foot
Curbs and gutter	Linear foot
Piping	Linear foot
Sand and Gravel	Cubic yard
Cement and Lime	Barrel (4 bags)
Concrete	Cubic yard (27 cu. ft.)
Concrete forms	Square foot of contact surface
Lumber	Feet, board measure (12" x 12" x 1")
Lawn work	1,000 square feet
Roofing	Square (100 sq. ft.)
Brick	Thousand
Plaster	Square yard
Stone	Cubic foot (instead of cord or perch)
Reinforcing steel	Pound or ton
Structural steel	Pound or ton
Painting	Square (100 sq. ft.)

### 6-13 DEVELOPMENT OF "STYLE"

It must be repeated that the aim in specification writing should be a clear presentation of facts, rather than an elegant or impressive style. With the preceding suggestions in mind, read critically specifications already written. Study how different paragraphs might be expressed more intelligibly, with fewer words in better arrangement, constantly striving for clarity and brevity. Even though you may be copying a printed specification of some manufacturer, it does not mean the document is perfect; usually there is plenty of room for improvement.

## CHAPTER 7

# Methods of Keeping Notes and Writing

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### 7-1 GENERAL

- a. Specification writing differs from other types of writing in that paragraphs developed for one specification are often reused in the preparation of other specifications, and paragraphs from catalogs and guide specifications are often copied. Although a novel may be 100% original work, a specification is often only a small fraction original work with a large amount of "plagiarism," except that in specification writing the literary theft is no crime and most guides are prepared for the sole purpose of being copied. The methods used for keeping notes and writing specifications are therefore different from those used in the preparation of essays, novels or the like.
- b. The methods evolved should accomplish the following:
  1. Allow for use of existing material;
  2. Organize the material;
  3. Preserve material prepared;
  4. Coordinate material with the drawings.

### 7-2 WHEN TO START PREPARING SPECIFICATIONS

- a. The ideal time to start writing a set of specifications would be when the working drawings for a particular job are completed, but this ideal is seldom realized owing to the pressure of time. To expedite the specification writing the writer should start preparing notes as soon as the working drawings are started; generally, the actual writing cannot begin before the plans and elevations are blocked out. During the period while the drafting force is preparing details and schedules and while the engineers are preparing their structural, mechanical and electrical drawings, the specification writer can get the bulk of his work done.
- b. The specification writer can begin early on such sections as *General Conditions*, *Earth Work*, *Concrete*, *Structural Steel*, which are not likely to undergo changes during the development of drawings. He should save for the last such sections as *Miscellaneous Metal Work*, *Finish Carpentry*, *Finish Hardware*, which are sure to be changed up to the

last minute. It is important that the specifications be developed along with the drawings, and they should be ready for final check about the same time the drawings are ready for final coordination and correction.

### 7-3 KEEPING NOTES

- a. It would be a very unusual person who could organize and carry in his mind all of the items to be included in the specifications for a medium-sized project; for those with average intelligence keeping notes is a far more accurate method. As the working drawings are developed, as changes are made in the working drawings, and as decisions are reached regarding methods, materials and finishes, the person charged with the responsibility of writing the specifications should make notes and keep them revised and up to date as ready reference and reminders during the specification writing period.
- b. Three methods of keeping notes are in general use:
  1. *Margin of Drawings:* If the individual preparing all or part of the drawings also will prepare the specifications, the simplest and most convenient way to keep notes is on the drawings outside of the cut line. This method works very well for small jobs.
  2. *Notebook:* If one can remember to keep a notebook available at all times and will consistently put his notes in the book, no better method can be found. Some attempt can be made toward the arrangement of the notes under section headings or they may be added indiscriminately and checked off as they are satisfied.
  3. *Separate Sheets of Paper or Cards:* Keeping notes on separate sheets of paper or cards has one big advantage—the notes may be arranged in proper sequence when the times comes for their use. Provided one can develop a system to prevent the misplacing or losing of notes, this is an excellent method. If guide paragraphs are kept on sheets of the same size and inserted in their proper position, paragraphs are easily rearranged, added or omitted without disturbing the other material.

### 7-4 PREPARATION OF AN OUTLINE

For any literary endeavor an outline should be prepared. This is particularly true for specification writing. After studying the drawings and making notes, select the necessary section titles and arrange them in logical order. Next, decide upon paragraph titles for each section and arrange these in proper sequence and the outline for the set of specifications is established.

### 7-5 WRITING SPECIFICATIONS

After the notes are complete regarding a particular construction job, the next step is to put them in a form to be typed. It would be rare for a speci-

fication writer to sit down and write out in longhand an entire set of specifications. It would take an unwarranted length of time to write out everything. With any set of specifications there will have to be some original writing, but text already prepared may and should be reused. The three general methods of compiling specifications are as follows:

1. *Writing Over Old Set:* If an architect has had a previous job similar to the one at hand, he may take the set of specifications covering the old job and by scratching out inapplicable portions and adding paragraphs to cover the specific job, prepare the copy for the new job to turn over to the stenographer to be typed. The danger of this method is that the old job may not include some material, equipment, or methods that the new job contains and these items may be overlooked unless the specification writer is very careful.
2. *Clipping and Stapling Method:* If the architect does not have a set of specifications similar to the job at hand, he may prepare his specifications by clipping from other specifications applicable paragraphs, stapling, pasting or taping them to sheets of paper in proper order for the new work, and inserting between these sheets new and proper original paragraphs. Thus he builds up a full set to be typed.
3. *Specification Paragraph Method:* In developing paragraphs for specifications some architects put each paragraph on a separate small sheet of paper or a card and develop a filing system for the sheets of paper or cards. The applicable ones for each set of specifications may be assembled, new paragraphs prepared and inserted, each on a separate sheet or card, as the job demands. After these have been typed, they are refiled and are thus made readily available for the next specification to be prepared. When these paragraph sheets are prepared, they should be double-spaced to facilitate corrections. It takes time to develop such a system and most specification writers under pressure do not have time to do so. Once it is organized, however, specification writing is facilitated to a great extent, and the paragraph sheet titles serve as a check list for the specification writer as he thumbs through them to pick out the ones presently needed.
4. *Use of Guide Specifications:* There are published guide specifications and work sheets as noted in Chapter 3 and there are guide specifications published by associations of the construction industry, by individual manufacturers and by agencies of public work. These guides can be filled in and edited by the specification writer to be used in his project specifications. One should be careful in the use of manufacturers' guide specifications because they tend to present qualifications that only their brand products can meet, and thus eliminate competition.

## CHAPTER 8

# Specification Format

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### 8-1 FORMAT

By the words *Specification Format* is meant the size and general style or "get-up" of a set of specifications. It is important to use a good format and thus present the specification text in a neat, orderly, standardized and readable manner.

### 8-2 SIZE OF SPECIFICATION SHEETS

The usual 8½" x 11" letter-size sheet should be used for the final specification sheets, since this is the most common size for all typed material in business. It is easy to handle and convenient for filing.

### 8-3 TITLE PAGE

- a. Specifications should have a title page for identification placed at the beginning, just as any other material in printed or book form. This sheet should begin:

"SPECIFICATIONS FOR"

and include:

1. Type of work (such as *construction of, alterations to or additions to*),
  2. Type and location of project,
  3. Name and address of Owner,
  4. Name and address of Architect,
  5. Job number and date.
- b. For a nice-looking title page, space lines evenly on an axis in groups, or arrange them asymmetrically as shown in Figure 8-1.

### 8-4 INDEX OF SECTIONS

- a. The title page of the specification is generally followed by an Index of Sections containing:

S P E C I F I C A T I O N S

FOR THE CONSTRUCTION OF

AN AUDITORIUM ADDITION TO  
CONSOLIDATED ELEMENTARY SCHOOL  
LAKEVIEW ROAD

FOR THE  
ENNITOWN BOARD OF EDUCATION  
CITY HALL  
ENNITOWN, GEORGIA

M. O. DERN, ARCHITECT  
157 CHERRY STREET  
ENNITOWN, GEORGIA

JOB NO. 365

AUGUST 4, 1960

FIG. 8-1 TYPICAL TITLE PAGE



1. Section numbers,
2. Section titles,
3. Section page numbers (for large jobs).

It may seem so, but it is not superfluous to include the section page numbers on the index sheet of a comparatively large set of specifications; it is of great assistance to the duplicator when assembling, and it avoids questions from bidders when they may fear they have a set with a few sheets missing. For typical index page see Figure 8-2.

- b. Attempts have sometimes been made to cross-index the paragraphs in specifications, but this is a laborious task, making the specifications more bulky, and the questionable advantage is not worth the effort. When the paragraphs are arranged by trade sections and each is distinguished by a title, it is generally easy to find information without a cross reference.

#### 8-5 TITLES

- a. Each section and each paragraph of a set of specifications should be titled and, of course, the title should indicate the content of each. Section titles should be capitalized and placed separately in the center of the new page, just as are ordinary chapter headings.
- b. Paragraph titles should be capitalized and underlined to distinguish them from the body of the text. The use of short paragraphs with appropriate titles facilitates reference without elaborate cross-indexing.

#### 8-6 BLOCK FORM

The block form of paragraphing is recommended, rather than the indented form, since it makes the titles and numbers stand out from the text, for ready reference. The typing should be single-spaced to reduce the number of pages, with the usual line skipped between all paragraphs, subparagraphs or items. Figure 8-3 shows a specification sheet written in the indented form; Figure 8-4 shows a specification sheet written in block form.

#### 8-7 NUMBERING SYSTEMS

When using numbers in specifications always use Arabic instead of Roman numerals. Very few people readily understand Roman numerals, and for almost anyone the high numbers can be confusing.

#### 8-8 PAGE NUMBERING

- a. Pages of specifications should always be numbered. If pages are numbered consecutively throughout regardless of sections, the entire specification will have to be written in proper sequence or completed before the typing is begun. It is, therefore, recommended that the pages be numbered consecutively by sections. Pages of *Section No. 1* would be 1-1,

I N D E X

<u>SECTION NO.</u>	<u>TITLE</u>	<u>PAGE NUMBERS</u>
1.	General Conditions	1-1 to 1-3
2.	Special Conditions	2-1 to 2-2
3.	Earth Work	3-1 to 3-2
4.	Concrete	4-1 to 4-4
5.	Masonry	5-1 to 5-5
6.	Waterproofing	6-1
7.	Miscellaneous Metal	7-1 to 7-2
8.	Metal Windows	8-1 to 8-2
9.	Metal Doors and Frames	9-1 to 9-2
10.	Rough Carpentry	10-1 to 10-2
11.	Finish Carpentry	11-1 to 11-4
12.	Finish Hardware	12-1 to 12-4
13.	Roofing and Sheet Metal	13-1 to 13-4
14.	Glass and Glazing	14-1
15.	Caulking	15-1
16.	Weatherstripping	16-1
17.	Lathing and Plastering	17-1 to 17-4
18.	Acoustic Treatment	18-1 to 18-2
19.	Marble and Tile	19-1 to 19-2
20.	Flooring	20-1 to 20-2
21.	Painting	21-1 to 21-5
22.	Kitchen and Cafeteria Equipment	22-1 to 22-6
23.	Plumbing and Heating	23-1 to 23-10
24.	Electrical	24-1 to 24-9

FIG. 8-2 TYPICAL INDEX PAGE. Column of page numbers often omitted on small jobs.

- (c) Hydrated Lime shall comply with ASTM Specification C-1141.
- (d) Fine Aggregate shall be natural white sand complying with ASTM Specification C-1141.
- (e) Water shall be fresh, clean and free from acid, alkali, oil or organic matter.
- 7-10. STRUCTURAL GLAZED UNITS:
- (a) Quality: Structural glazed units shall be Select Quality in accordance with grading rules of the Facing Tile Institute, Washington, D.C.
- (b) Sizes: Structural Glazed tile shall be of thicknesses to develop the partition or wall thicknesses shown on the drawings and of the following face sizes:
- (1) For Lobby, 7-3/4" x 15-3/4" Series 8W and 2-3/8" x 3-3/4" Series 4S.
  - (2) For All Other Interior Structural Glazed Tile, 5-1/3" x 12", Series 6T.
  - (3) For Ticket Booths, 7-3/4" x 7-3/4" Series 4W.
  - (4) For All Other Exterior Structural Glazed Tile, 7-3/4" x 15-3/4", Series 8W.
- (c) Special Shapes: Include all special shapes such as bullnoses, cove bases, curved pieces and partition caps where required. All corners shall be bullnose or cove.
- (d) Color: Structural glazed tile where used shall have color and finish selected by the Architect similar to the following:
- |                         |                     |
|-------------------------|---------------------|
| Lobby and Lobby Alcoves | Green Brown Mottle  |
| Exterior                | Yellow Matt         |
| All Other Tile          | Clear Ceramic Glaze |
- 7-11. ANCHORS AND TIES for masonry shall be as follows:
- (a) Wall Anchors for securing partitions to adjoining construction where bonding is impracticable shall be not less than 1/4" x 1-1/4" galvanized metal bars with ends turned up 2". Anchors shall extend not less than 8" into brickwork and 12" into other masonry and shall be placed approximately 2'-0" o. c. in height.
- (b) Dovetail Anchors: Where structural glazed tile occurs against or abuts concrete it shall be anchored with 16 gauge galvanized metal dovetail anchors, 1" wide, spaced approximately 2'-0" o.c. in height. Slots to receive these anchors are specified in "Concrete section.
- (c) Wall Ties: Furring built flat against masonry shall have ties spaced approximately 2'-0" apart horizontally and not over 1'-6" apart vertically. Ties shall extend not less than 4" into masonry backing and to within 1/2" of the

FIG. 8-3 TYPICAL SPECIFICATION PAGE SHOWING INDENTED FORM

## 7-2

- c. Hydrated Lime shall comply with ASTM Specification C-141.
- d. Fine Aggregate shall be natural white sand complying with ASTM Specification C-144.
- e. Water shall be fresh, clean, and free from acid, alkali, oil or organic matter.

7-10 STRUCTURAL GLAZED UNITS:

- a. Quality: Structural glazed units shall be Select Quality in accordance with grading rules of the Facing Tile Institute, Washington, D. C.
- b. Sizes: Structural glazed tile shall be of thicknesses to develop the partition or wall thicknesses shown on the drawings, and of the following face sizes:
  - 1. For Lobby, 7-3/4" x 15-3/4" Series 8W and 2-3/8" x 3-3/4" x 7-3/4" Series 4S.
  - 2. For All Other Interior Structural Glazed Tile, 5-1/8" x 12" Series 8T.
  - 3. For Ticket Booths, 7-3/4" x 7-3/4" Series 4W.
  - 4. For All Other Exterior Structural Glazed Tile, 7-3/4" x 15-3/4" Series 8W.
- c. Special Shapes: Include all special shapes such as bullnoses, cove bases, curved pieces and partition caps where required. All corners shall be bullnosed or coved.
- d. Color: Structural glazed tile where used shall have color and finish selected by the Architect and similar to the following:
 

Lobby and Lobby Alcoves	Cream Brown Mottle
Exterior	Yellow Matt
All Other Tile	Clear Ceramic Glaze

7-11 ANCHORS AND TIES for masonry shall be as follows:

- a. Wall Anchors for securing partitions to adjoining construction where bonding is impracticable shall be not less than 1/4" x 1-1/4", galvanized metal bars with ends turned up 2". Anchors shall extend not less than 8" into brickwork and 12" into other masonry, and shall be placed approximately 2'-0" o.c. in height.
- b. Dovetail Anchors: Where structural glazed tile occurs against or abuts concrete it shall be anchored with 16 gauge galvanized metal dovetail anchors, 1" wide, spaced approximately 2'-0" o.c. in height. Slots to receive these anchors are specified in "Concrete" section.

FIG. 8-4 TYPICAL SPECIFICATION PAGE SHOWING BLOCK FORM

1-2, 1-3, etc., and of *Section No. 10*: 10-1, 10-2, 10-3, etc. With this numbering system the typist can begin typing sections as soon as they are written no matter which section is prepared first, and if paragraphs or whole pages are later added to a section, the entire page numbering system will not be upset.

- b. The typist often needs the space at the bottom of a page to complete a sentence or a paragraph and sometimes there is very little space left for a page number. Also, most books are numbered in the upper right-hand corner; therefore, it is recommended that the page numeral be placed in the upper right-hand corner of the sheet as shown by Figure 8-4 instead of the bottom of the sheet as shown in Figure 8-3.

### 8-9 SECTION NUMBERING

As previously discussed, the sections of a set of specifications are arranged according to trades, in the general order of construction. These sections, therefore, would be numbered consecutively, with *General Conditions* usually *Section No. 1*, on through to the final sections. Each section should be clearly numbered, as well as titled, for easy reference.

### 8-10 PARAGRAPH NUMBERING

In specifications for small jobs it is recommended that paragraphs be titled but not numbered, as such numbering requires extra time for the specification writer and the typist. When paragraphs are numbered for specifications of larger work, they should be numbered consecutively for each section. Thus in *Section No. 1*, paragraphs would be numbered; 1-01, 1-02, 1-03, etc., and in *Section No. 2*, 2-01, 2-02, 2-03, etc. The 0 is added in front of single numerals to register correctly with numbers of two digits for the typist's convenience.

### 8-11 SUBPARAGRAPHS

- a. In specifications written for the construction of residences or other small jobs, subparagraphs are not recommended; see Figure 8-5. Their use in specifications for larger work may be of advantage, however; see Figure 8-4. The subparagraphs can be identified by letters *a*, *b*, *c*, etc., and these may be further divided into items identified by numbers 1, 2, 3, etc., the specification itself being an elaboration of an outline. Parentheses are not necessary when block form is used since the possibility of confusing the letters and numerals in the text is minimized.
- b. The typical specification sheets, Figures 8-4 and 8-5, illustrate more clearly than words the format suggestions outlined in this chapter. The specification sheet shown by Figure 8-4 is typical for a large job, whereas the sheet shown by Figure 8-5 is typical for a small job.

7-1

SECTION 7ROUGH CARPENTRY

LUMBER: Framing lumber shall be No. 1 Dimension Southern Pine or No. 1 Dimension Douglas Fir and sheathing and grounds shall be No. 2 Boards of Southern Pine or No. 2 Common Douglas Fir. Graden refer to the grade rules of the Southern Pine Association and the Western Pine Association. Lumber shall be new, sound, S&S and air dried to a moisture content not exceeding 19%.

ROUGH HARDWARE: Bolts, screws and nails shall be of proper size to securely hold members in place. Sill bolts shall be  $3/4"$  x  $15"$  spaced  $6'-0"$  o.c. Each bolt shall be equipped with 1 nut and 2 washers.

FRAMING: Framing lumber shall be closely fitted and accurately set to required lines and levels and rigidly secured in place. All horizontal framing members shall have at least  $2"$  bearing on both ends. Keep framing at least  $2"$  away from chimney masonry.

CUTTING: Where it is necessary to cut framing members to allow for installation of electrical, plumbing or heating work, the members so cut shall be properly reinforced with headers the full depth of the members or with steel straps.

SILLS shall be of  $2 \times 8$  plates with  $2"$  header. Use mortar for leveling plates.

BEAMS shall be  $4"$  thick and depth of joists or two joists securely nailed together may be used. Attach  $2 \times 4$  lodgers.

JOISTS, except where otherwise indicated, shall be  $2 \times 10$ 's spaced  $16"$  o.c. All joists shall be doubled under partitions and around stair well, chimney and other openings.

CROSS BRIDGING: Joists over  $6'-0"$  in span shall be bridged with one row of  $1 \times 3$  cross bridging cut on bevel and driven up tight.

TERMITE SHIELDS are specified in "Roofing and Sheet Metal" section.

WALL AND PARTITION FRAMING, except where otherwise shown on drawings, shall be of  $2 \times 4$  studs spaced  $16"$  o.c. with single sole plate at bottom and double plate at top. Studs shall be doubled at sides of all openings and headers shall not exceed the following.

Spans up to $3'-6"$	Two $2 \times 4$ 's
Spans $3'-7"$ to $4'-6"$	Two $2 \times 6$ 's
Spans $4'-7"$ to $6'-0"$	Two $2 \times 8$ 's
Spans over $6'-0"$	Two $2 \times 10$ 's and braced

FIG. 8-5 TYPICAL SPECIFICATION PAGE FOR SMALL JOB

## CHAPTER 9

# Printing, Binding and Distribution

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### 9-1 GENERAL

Once written, the specifications must be assembled in a useful form for distribution to the various individuals concerned. One set for the Owner (whether he ever reads them or not), one set for the Architect's reference, one set for each general contractor who bids on the job—these and others are needed. The bound form for the specifications is subject to innumerable variations, but it should be borne in mind that sets will be distributed to various people on a construction project.

### 9-2 DUPLICATING SPECIFICATIONS

- a. More than one set of specifications is required on all construction work. As times progress, more and more sets of drawings and specifications are required: the city may wish to retain one when it issues a permit; the company making the mortgage loan on the building may wish to retain one. As more work is subcontracted by the General Contractor, additional sets of prints and specifications are necessary.
- b. Various methods of duplicating the original specification are used to supply the several sets necessary. The following methods of duplicating specifications are generally employed:
  1. *Carbon Copies*: On a typewriter, by using very thin carbon and onion skin paper, it is possible to get six readable copies in addition to the original. This will provide only seven complete sets of the specifications and, in many cases, they are not sufficient. It is, therefore, very wise to *back-carbon* the original copy by placing a seventh sheet of carbon paper with its carbon face towards the back of the first sheet. As the words are typed on the face of the original sheet, the carbon darkens the back of each letter thus giving a very black impression, and these sheets may be used for blueprinting additional copies if necessary to provide a few more sets of specifications. Blueprinting specifications is expensive, however, and should be avoided. If it is

known beforehand that more than seven copies of a specification will be needed, then some other method of duplication should be employed. Reproduction of specifications by carbon copies can be used only for residential and other small work.

2. *Spirit Duplicating:* In this duplicating process the master sheet is backed up with a special type of paper covered with an indelible ink which transfers to the back of the sheet as it is being typed. This sheet is put into a machine and, by a spirit (volatile substances dissolved in alcohol) process, the indelible ink comes off on additional sheets as they pass through the machine. It is possible by this method to get approximately 150 readable copies. The first copies are darker than the last copies coming through the machine. The cost of spirit duplicating is approximately the same as mimeographing. One objection to this system is the use of the indelible impression; most stenographers object to its use because it is difficult to keep the indelible ink from staining the hands. It is very difficult to make corrections on the master sheet, for it has to be erased on the back and front of the sheet, and this takes more stenographic time. Also, the readability of purple ink on white is not as good as the black on white produced by mimeographing.
3. *Mimeographing:* The most widely used method of duplicating specifications is by mimeographing. A typewritten impression is made on a stencil sheet, after which the stencil is attached to a mimeographing machine drum, and ink passing from the drum through the impression on the stencil is absorbed by the sheets fed into the machine. This process has the advantage of providing a master from which hundreds of prints may be made. The stencils are easily corrected by applying correction fluid and retyping the correction. The work of cutting stencils for the stenographer is fast and clean, although the mimeographing process itself has its disadvantages because of the ink involved. For this reason, and because of the expense of the machines, many architectural firms send their stencils to commercial duplicating offices after the stencils have been cut by the architect's stenographer.
4. *Other Methods:* Multilithing, multigraphing and printing are sometimes used for duplicating specifications, but these methods are feasible only when a large quantity of specifications is necessary, such as the master specifications prepared by a large corporation or Government agency for national use. It would be rare for an architectural firm to have a job that would make it economical to reproduce specifications by multilithing, printing or multigraphing. For multilithing, an expensive plate has to be made, while in the other proc-



esses, type has to be set. The initial cost is great and has to be absorbed by many printed copies. To improve the appearance of specifications for their large projects, however, many architects have the cover sheets printed.

### 9-3 PAPER

Type of paper used depends upon method of reproduction. Thin onion skin paper is used for direct copies, special paper is used for spirit duplicating, and a particular absorbent type of paper is used for mimeographing work. All paper should be of good quality to reduce tearing as the specifications are frequently used and receive rough treatment out on a job.

### 9-4 BINDING SPECIFICATIONS

- a. Some offices in binding specifications always use a method whereby the individual sections may be removed or addenda inserted without too much effort and without mutilating the specifications themselves. Changes after a job is out for bids necessitate addenda and, although it is not considered good policy, contractors sometimes separate the sections for distribution to subcontractors for bids.
- b. Most office supply stores sell folders which are known as *brief folders*. These come equipped with staples or may be used with special fasteners. If the specifications are comparatively thin, they can be punched and inserted in these folders, making a neat binding job, with pages easily removed or inserted.
- c. For specifications over  $\frac{1}{4}$ " thick special covers should be cut and punched to accommodate the specifications. These covers should be made of a thick and durable hard-surfaced paper. Although the sheets can be neatly bound by using staples and glueing a strip at the bound edge, it is far better to use special fasteners to facilitate the removal of sheets, omitting the glued edge strip.
- d. Specifications should be bound at the left side to open as a book for convenience; specifications bound at the top are more difficult to handle.

### 9-5 DISTRIBUTION

- a. The specifications are distributed with the drawings, and the minimum number of specifications usually needed is 7 as follows:
  1. One set for the Architect's office,
  2. One set for the Owner,
  3. One set for the City (required before permit is issued),
  4. One set for the General Contractor,
  5. One set for the General Contractor's field office,

6. One set to be separated and sent to Subcontractors (which incidentally is not good practice),
  7. One set for Lending Agent (required before loan is made).
- b. There are often more sets required than listed above, especially during the bidding period, if there are many bidders. If the bidding period is limited to a very short time, the bidders are usually issued more than one set of the specifications and prints. Although residential work might be limited to 7 complete sets in all, larger work will require from 35 to 75 sets.
- c. Additional sets of specifications will be useful as *cut-up* sheets in the preparation of future specifications.

## CHAPTER 10

# Supplemental Documents

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### 10-1 SUPPLEMENTAL DOCUMENTS

- a. There are several documents closely related to or supplementing the specifications that are often bound with the specifications, usually at the front of the set. Although on less formal work some of these documents are not used and others may be in the form of letters, a set of specifications is prepared with these documents in mind and the information contained in them is purposely omitted from the specifications to avoid duplication. These supplemental documents are illustrated in the Appendices to this chapter.
- b. Supplemental documents are *Advertisement or Invitation to Bid*, *Instruction to Bidders*, *Bid Form*, *Form of Bid Bond*, *Contract Form*, *Form of Performance Bond* and *Form of Payment Bond*. These cover many legal aspects of the construction work; some of these are printed—others may be written expressly for each new job.
- c. Other supplemental documents prepared after the specifications have been issued for bidding purposes include *Addenda* and *Letter of Intent*. Documents prepared after the Contract has been executed include *Change Orders* and *Certificates for Payment*.

### 10-2 ADVERTISEMENT

- a. The purpose of advertising, or giving notice to contractors of proposed construction, is to ensure fair competition for the work and to notify all parties who might be interested in submitting bid proposals. The statutes of the U. S. Government declare that all purchases for supplies or services, in any of the departments of the Government, shall be made by advertising for proposals respecting the purchases (with certain qualifications). All Federal and public work should be advertised; this is generally done by inserting the advertisement in one or more newspapers or

magazines of large circulation, or, on smaller work, by posting notice in a public space such as Court House Lobby or Post Office.

- b. It is also expedient to advertise other than public work when it is desirable to open the bidding to all interested contractors. This type of advertising is usually done through contractors' associations, builders' exchanges or building news agencies such as the F. W. Dodge Corporation. The Advertisement soliciting bids should contain the following essential information.
  - 1. Place, date and time for opening bids.
  - 2. Type and location of work.
  - 3. Indication of size or extent of work.
  - 4. How the work is to be financed (if public work).
  - 5. Statement as to where plans and specifications may be secured and the amount of deposit required.
  - 6. Bid bond or certified check requirement.
  - 7. Performance and payment bond requirement.
  - 8. Statement of right to reject bids.
  - 9. Name and address of Owner.
- c. See Appendix 10-1 for example of typical Advertisement.

### 10-3 INVITATION TO BID

An Invitation to Bid takes the place of the Advertisement on private work when bidding is to be limited to a selected list of bidders.

### 10-4 INSTRUCTIONS TO BIDDERS

- a. Instructions to Bidders are written instructions sent to bidders with the plans and specifications. Instructions may repeat the pertinent information included in the Advertisement and Invitation to Bid and may also include such information and instructions as:
  - 1. Procedure for preparing and signing bid.
  - 2. Procedure for sealing, addressing and delivering bids.
  - 3. Procedure for returning plans and specifications.
  - 4. Procedure when discrepancies are discovered.
  - 5. Amount of bid bond or certified check required as bid surety.
  - 6. Procedure to be followed for opening of bids.
  - 7. Procedure to be followed for withdrawal of bids.
  - 8. Basis for rejection and award of bids.
- b. It is rarely necessary to send Instructions to Bidders on residential and other small private work. See Appendix 10-2 for typical Instructions to Bidders. If the presentation of bidder's financial statement or experience record is required, it should be set forth in the Instruction to Bidders.

### 10-5 BID FORM

- a. A Bid Form is generally prepared and sent to all bidders in order to assure similarity in the preparation and presentation of bids and to give a uniform basis of comparison.
- b. This bid form should contain the necessary description of the work and have blank spaces to be filled in including the following:
  1. Type of organization bidding.
  2. Amount of base bid.
  3. Amount of each unit price for additional work which may be required.
  4. Amount of addition to or deduction from base bid for each Alternate.
  5. Number of calendar days for completion.
  6. Signature, title and address of bidders.
- c. See Appendix 10-3 for typical Bid Form.

### 10-6 BID BOND

- a. To be certain that a contractor will not submit a bid on work and then refuse to accept a contract based on his bid, on Federal, public and private construction work for larger companies or corporations a Bid Bond or certified check is required, usually in the amount not less than 3% (or 5%) of the amount of the bid. Such a bond or certified check is submitted by the Contractor with the understanding that it shall guarantee that the bidder will not withdraw his bid for a period of 60 days after opening of bids and that, if his bid is accepted, he will enter into a formal contract with the Owner; otherwise, the Contractor is liable for the full amount of the bond or the certified check is to be forfeited. See Appendix 10-4 for form of Bid Bond.

### 10-7 SPECIFICATION ADDENDA

- a. The definition of an addendum is *a thing added*, but the definition of a Specification Addendum should be *an amendment to a set of specifications*. Some architects refer to addenda as bulletins. After the specifications are completed and bound, and before and during the preparation of bids, there may be certain corrections, clarifications, additions or deletions to be made to the specifications; this is accomplished by issuing addenda to the specifications.
- b. An addendum should always refer to the specific section and paragraphs of the specification which is involved. On small work the addendum may be in the form of a letter to all bidders, while on larger work it is a more formal document. A typical Addendum is shown in Appendix 10-5.
- c. Reasons for addenda:

1. To answer questions raised by bidding contractors.
  2. To effect changes made by Owner.
  3. To correct errors and discrepancies between plans and specifications.
  4. To add or deduct materials, equipment, qualifying statements or methods inadvertently omitted or included in the original specifications.
  5. To substitute materials or equipment for those unavailable.
  6. To include a product when Subcontractor or Vendor points out that his product is excluded by some requirements not necessarily affecting performance or quality.
- d. Telephone answers to bidders' questions are dangerous. They should always be confirmed in writing to all bidders and should not occur if it is too late to accomplish such confirmation. It is important that the same information be available to all bidders.

#### 10-8 PUBLIC OPENING OF BIDS

It is required by law on certain types of Federal, State and other public construction projects that the bids be publicly opened at a stipulated time and place, and the contents read aloud to those present. This is not mandatory for private work, but a far better relation between Architect and Contractor can be maintained if it is done. If the Owner has no objection, the Architect is wise to open the bids before all the bidders who wish to be present. Since contractors go to a great expense in preparing estimates, it is only fair they should be assured by a public opening that their bids are not being used merely for "shopping" purposes, i.e., used as a means to force a favored contractor's bid price down. (This applies to lump-sum contract letting and not to negotiations for a cost plus a fee or a percentage type of contract, which are usually done privately.)

#### 10-9 LETTER OF INTENT

After bids are opened, the Owner is seldom in a position to execute a formal contract immediately. Both he and the Contractor need some time to study the contract before signing, and the Owner usually requires a few days to set up his financial arrangements for the project. If the Owner is a large corporation or a Government agency, it will sometimes take weeks for the contract to be reviewed by different departments and to be initialed and signed by the proper parties. To avoid delays it is customary for the Owner to authorize the Architect to write a *Letter of Intent* to the Contractor selected, enabling the work to begin, although many of the fine legal points are not covered. For a typical *Letter of Intent*, see Appendix 10-6.

## 10-10 TYPES OF CONTRACTS

- a. There are several types of agreement which may be drawn up between Owner and Contractor. Each has advantages and disadvantages. As previously mentioned, the contract types are as follow:
- b. *Lump-Sum Contract*: An agreement whereby a Contractor undertakes work for a predetermined lump-sum figure. This form of contract is highly recommended for new construction work of a small or large nature, where the cost can be determined in advance. It is of advantage to the Owner to know what his costs are going to be before any work is undertaken. Competitive bids can be received before entering into contract, and the Owner can take advantage of the low bid. In the competitive bid system it is not uncommon for the difference between the high and low bids to exceed the Architect's fee. This is certainly a good argument for the value of an Architect's drawings and specifications.
- c. *Cost-Plus-a-Percentage Contract*: An agreement whereby a Contractor undertakes work for which he is reimbursed his costs plus an established percentage of the costs to cover his overhead expenses and profit. This type of contract is recommended for alteration work or where it is difficult to establish by drawings and specifications the definite extent of the work involved.
- d. *Cost-Plus-a-Fixed-Fee Contract*: An agreement whereby a Contractor undertakes work for which he is reimbursed his costs plus a fixed fee to cover his overhead and profit. This type of contract is also recommended for alteration work and where it is difficult to establish definitely the extent of the work involved, or where it is necessary to obtain a Contractor of special ability. In most cases this type of contract is superior to the cost-plus-a-percentage as it eliminates a possible incentive for the Contractor to permit the work to be costly. The A.I.A. has a standard form (No. A-111), not reprinted herein, for contracts of this kind.
- e. *Unit Price Contract*: An agreement whereby a Contractor undertakes work for which he is compensated by predetermined unit costs for units of work performed. This type of contract is adaptable to large jobs where relatively few types of work are involved and the quantities cannot be determined in advance, such as large grading, excavating, paving, pile driving and soil erosion control work. This contract type would be too involved to use satisfactorily for the construction of an average building.

## 10-11 FORM OF AGREEMENT

The A.I.A. Standard Form of Agreement between Contractor and Owner for Construction of Buildings is reprinted as Appendix 10-7. This form is usually filled in by the Architect and submitted to the Owner and Contractor for their lawyers to review and for their signatures. (The form of agree-

ment shown is only for a lump-sum type of contract.) No construction work should be undertaken without a signed agreement between Owner and Contractor.

#### 10-12 THE GENERAL CONDITIONS OF THE CONTRACT FOR THE CONSTRUCTION OF BUILDINGS

A Standard Form of the American Institute of Architects to be used with the A.I.A. Standard Form of Contract (see Appendix 10-7) is reproduced as Appendix 10-8. These general conditions are discussed in the next chapter.

#### 10-13 FORM OF PERFORMANCE BOND

- a. For the Owner, the basic purpose of a bond is to eliminate risk and give him financial protection against default by the Contractor. The Performance Bond assures performance of a specific construction contract in accordance with its terms and conditions. In addition to this, it serves as an extension of credit to the Contractor and tends to eliminate the irresponsible or unqualified contractor. (Unfortunately this is not always the case, of course; the bond in such instance affords credit to a contractor who might not be able to get credit from material dealers.)
- b. Under the Heard Act of 1894 and the Miller Act of 1935, Performance and Payment Bonds are required for all Federal construction contracts exceeding \$2,000 in amount, and they are required by other statutory and legal requirements for public works. The Form of Performance Bond, reprinted as Appendix 10-9, approved by the American Institute of Architects, is recommended for private construction work.

#### 10-14 FORM OF PAYMENT BOND

A payment bond guarantees prompt payment of all proper labor and material bills in the performance of a specific construction contract. This type of bond gives subcontractors and suppliers of labor and material a certainty of payment and eliminates the hazard of the filing of liens and claims against the Owner's property which encumbrances would cloud the title. The Payment Bond is also required by law for Federal and public work. The Form of Labor and Material Payment Bond, reprinted as Appendix 10-10, approved by the American Institute of Architects, is recommended for private construction work.

#### 10-15 CHANGE ORDER

- a. A Change Order is an order issued by the Architect to the Contractor during the construction period for any change to the original contract documents. Each Change Order is usually accompanied by revisions to



the drawings or an Addendum to the Specifications (sometimes called *Specification Change*). Often the contract price and completion date are affected by a Change Order. All Change Orders should be signed approved by the Owner.

- b. Changes during the course of construction are made necessary for many reasons; some of them are:
  - 1. Changes requested by the Owner.
  - 2. Changes due to purchase of equipment or materials not originally specified.
  - 3. Changes caused by job site conditions not known before date of contract.
  - 4. Changes due to nonavailability of specified materials or equipment.
  - 5. Changes to correct errors or omissions on drawings or in specifications.
  - 6. Changes requested by Contractor based on his experience and methods.

For typical A.I.A. Change Order form, see Appendix 10-11.

#### 10-16 CERTIFICATE FOR PAYMENT

As usually established by the Contract between Contractor and Owner monthly payments are made to the Contractor by the Owner. The Contractor usually sends his requisition for payment to the Architect, based on percentages of work completed as applied to a schedule of values. After the requisition has been checked a certificate is prepared on a special form and sent to the Owner. Many Architects use the A.I.A. standard form shown in Appendix 10-12.

#### 10-17 CONTRACT DOCUMENTS

One of the services performed by the Architect most appreciated by the Owner is the *preparation* and *administration* of the supplemental documents listed in this chapter. These documents, together with the general conditions, the specifications and drawings, are termed the Contract Documents. The preparation of them is often the province of the specification writer, who should most certainly be familiar with them. The Architect should advise the Owner to provide such legal advice as may be needed.

## ADVERTISEMENT (Example)

ADVERTISEMENT

Sealed bids will be received in the office of the Board of Education of the City of Ennitown, Georgia, 2nd floor, City Hall, up to 4 o'clock P.M., September 8, 1963, for the furnishing of all labor and materials necessary for construction of an Auditorium Addition to the Consolidated Elementary School, Lakeview Road, according to plans and specifications. The Auditorium will be of a size to seat 250 people.

Construction to be financed by funds from the 1962 bond issue for public schools. Drawings, specifications and bid forms may be obtained on deposit of \$15.00 from M.O. Dern, Architect, 157 Cherry Street, on and after August 5, 1963. Deposits for drawings and specifications will be returned in full if the items are returned in good condition five days after bids are opened.

Bids shall be accompanied by a certified check or by a Bid Bond made payable to the Board of Education of the City of Ennitown in an amount equal to 5% of the bid price. The successful bidder will be required to furnish a Performance and Payment Bond acceptable to the Board of Education in an amount equal to 100% of the contract price and executed by a surety company licensed to do business in the City of Ennitown.

The Board of Education reserves the right to accept or reject any or all bids and to waive technicalities.

ENNITOWN BOARD OF EDUCATION

By M.N. Noble, Superintendent

## INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

1. PROPOSAL FORMS: Four copies of the bid form are furnished. All blank spaces on forms shall be fully filled in, and signatures shall be in longhand and executed by a principal duly authorized to make contracts. The bidder's legal name shall be fully stated. Please execute and return three copies of the bid form at the time stipulated.
2. ADDRESSING ENVELOPES: Bidder's proposal shall be placed in an envelope of the concern submitting the proposal, sealed and addressed as follows:  

M.O. Dern, Architect  
157 Cherry Street  
Ennitown, Georgia
3. DRAWINGS, SPECIFICATIONS AND OTHER DATA: All documents transmitted for the purpose of preparing proposals shall be returned to this office with the proposal, or not later than the date the proposals are to be received.
4. DISCREPANCIES: Should a bidder find discrepancies or ambiguities in, or omissions from the drawings or specifications, or should he be in doubt as to their meaning, he shall at once notify the architect who may send a written addendum simultaneously to all bidders. The architect will not be responsible for any oral instructions. All addenda to bidders are incorporated by reference in the proposal.
5. BID GUARANTEE: Bids shall be accompanied by a bid guarantee of not less than 5% (or 3%) of the amount of the bid, which may be a bid bond or a certified check made payable to the Owner. Such bid bond or check shall be submitted with the understanding that it shall guarantee that the bidder will not withdraw his bid for a period of 60 (or 30) days after the scheduled closing time for the receipt of bids; that if his bid is accepted, he will enter into a formal contract with the Owner and that the required performance bond will be given and that in the event of the withdrawal of bid within stated period or the failure to enter into contract and give bond within 10 days after he has received notice of the acceptance of his bid, the bidder shall be liable to the Owner for the full amount of the bid guarantee as representing the damage to the Owner on account of the default of the bidder in any particular thereof.

The bid bonds and checks shall be returned to all except the three lowest bidders within three days after the formal opening of bids. The bid bond or check of each of the three lowest bidders will be returned within 48 hours after the Owner and Contractor have executed the contract and the executed performance bond has been approved by the Owner.

## INSTRUCTIONS TO BIDDERS (CONT.)

6. OPENING OF BIDS: At the time and place fixed for the opening of bids, every bid received within the time fixed for receiving bids will be opened and publicly read aloud, irrespective of any irregularities therein. Bidders and other persons properly interested may be present, in person or by representative.
7. WITHDRAWAL OF BIDS: Bids may be withdrawn on written or telegraphic request dispatched by the bidder in time for delivery in the normal course of business prior to the time fixed for opening; provided that written confirmation of any telegraphic withdrawal over the signature of the bidder is placed in the mail and postmarked prior to the time set for bid opening. Negligence on the part of the bidder in preparing his bid confers no right of withdrawal or modification of his bid after such bid has been opened.
8. AWARD OR REJECTION OF BIDS: The Contract will be awarded to the lowest responsible bidder complying with conditions of the invitation for bids, provided his bid is reasonable and it is to the interest of the Owner to accept it. The bidder to whom the award is made will be notified at the earliest possible date. The Owner, however, reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in the interest of the Owner. The Owner also reserves the right to reject the bid of a bidder who has previously failed to perform properly or complete on time contracts of a similar nature, or a bid of a bidder who is not in a position to perform the contract.

## BID FORM

B I D

Place \_\_\_\_\_

Date \_\_\_\_\_

TO: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_In response to your invitation, the undersigned, \_\_\_\_\_  
\_\_\_\_\_a corporation organized and existing under the laws of the state of \_\_\_\_\_  
\_\_\_\_\_, a partnership consisting of \_\_\_\_\_  
\_\_\_\_\_, or an individual trading  
as \_\_\_\_\_of the city of \_\_\_\_\_, \_\_\_\_\_, hereby proposes to  
furnish all labor and material and perform all work required for the \_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_, located at \_\_\_\_\_  
in strict accordance with the specifications dated \_\_\_\_\_,  
the articles of contract, all addenda and the drawings mentioned therein,  
for the consideration of \_\_\_\_\_

\_\_\_\_\_ Dollars (\$\_\_\_\_\_).

## BID FORM (CONT.)

## UNIT COSTS

(1). The proposed unit cost for earth excavation, omitted or added, as described in the specifications, is \$ \_\_\_\_\_ per cubic yard.

(2). The proposed unit cost of rock excavation which may be encountered is \$ \_\_\_\_\_ per cubic yard.

(The above are examples; here  
continue list of unit costs)

## ALTERNATES

(1). If asphalt shingles as described in the specifications are substituted for asbestos shingles, add or deduct (state which) from the base bid the sum of \$ \_\_\_\_\_.

(The above is an example; here  
continue list of alternates)

The undersigned agrees to execute the agreement entitled, A.I.A. Short Form for Small Construction Contracts within 60 days after notification in writing.

The undersigned propose to complete this work in \_\_\_\_\_ calendar days from \_\_\_\_\_.

The undersigned will not make subsequent request for extras due to not having visited the site.

\_\_\_\_\_  
(Individual or Firm Name)

By \_\_\_\_\_

Title \_\_\_\_\_

\_\_\_\_\_  
(Business Address)

## BID BOND FORM

A.I.A. DOCUMENT NO. A-310

(1968 Edition)

## BID BOND



*This document approved and issued by The American Institute of Architects  
1735 New York Avenue, N. W., Washington 6, D. C.*

## KNOW ALL MEN BY THESE PRESENTS,

That we, .....  
..... (hereinafter called the "Principal"),

as Principal, and the .....  
..... of .....,

a corporation duly organized under the laws of the State of .....  
(Hereinafter called the "Surety"), as Surety, are held and firmly bound unto .....

..... (Hereinafter called the "Obligee"),  
in the sum of ..... Dollars

(\$ .....), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for .....

## BID BOND FORM (CONT.)

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this ..... day of ..... A.D. 19 .....

.....	}	..... (Seal)
		(Principal)
		..... (Title)
.....	}	..... (Seal)
		(Surety)
		..... (Title)



## TYPICAL ADDENDUM

ADDENDUM NO. 1

## AUDITORIUM ADDITION

## TO THE

CONSOLIDATED ELEMENTARY SCHOOL  
ENNITOWN, GEORGIA

AUGUST 14, 1963

The specifications prepared by M.O. Dern, Architect, for the construction of an Auditorium Addition to the Consolidated Elementary School, Lakeview Road, Ennitown, Georgia, dated August 4, 1963, are hereby amended in the following particulars:

Par. 4-18 STEPS: At the end of this paragraph add the following:

"The steps from the Corridor to the Vestibule of the Dressing Room shall be of concrete with metal nosing as shown by Section H-H instead of wood steps as noted on the drawings."

Par. 5-06 COMMON BRICK: Delete the last sentence of this paragraph in its entirety and substitute the following:

"Common brick shall be used for back-up only for stonework wall supporting canopy and where Auditorium joins existing building at Corridor where 8" brick wall is shown. All other back-up work shall be done with 8" x 8" x 16" concrete block made with light-weight aggregate and meeting the requirements of ASTM Spec. C-90 for hollow, load-bearing concrete block. The concrete block shall be reinforced with galvanized steel trussed design reinforcement made of No. 9 (.1483") gauge installed in every other horizontal joint."

Par. 15-06 FLASHING: At the end of this paragraph add the following:

"The metal counterflashing and metal gutter shown by the section through head of Door No. 1 and Section D-D on Drawing No. 7 shall extend into the masonry 4" and turn up 1". The remainder of the flashing shown in these sections is classified as spandrel flashing and installed as specified in the 'Masonry' Section."

Par. 15-08 ROOFING: In the fourth line of this paragraph, delete the word "asphalt" and substitute the word "asbestos".

## TYPICAL LETTER OF INTENT

September 10, 1963

A. and B. Construction Company  
541 Apricot Street  
Ennitown, Georgia

Re: Auditorium Addition to  
Consolidated Elementary School  
Ennitown, Georgia

Gentlemen:

The Ennitown Board of Education on September 9, 1963 authorized us to notify you that your bid in the amount of \$82,981.40 for the construction of an Auditorium Addition to the Consolidated Elementary School on the Owner's property on Lakeview Road according to plans and specifications prepared by this office has been accepted. The contract lump sum quoted above is determined as follows:

Original Base Bid . . . . .	\$84,752.00
Alternate No. 1 add \$350.40	
Alternate No. 3 add \$ 50.00	
Total Additions . . . . .	400.40
Subtotal	\$85,152.40
Alternate No. 4 deduct \$1,450.00	
Alternate No. 6 deduct 721.00	
Total Deductions	2,171.00
CONTRACT LUMP SUM	\$82,981.40

The formal contract will be prepared for signatures as soon as possible. In the meantime you are authorized and urged to purchase materials and proceed with the work.

Very truly yours,

M.O. DERN, ARCHITECT

By \_\_\_\_\_

CC: Board of Education

## FORM OF AGREEMENT

A.I.A. DOCUMENT NO. A-101

(Formerly Form A1) 1958 Edition

# THE STANDARD FORM OF AGREEMENT BETWEEN CONTRACTOR AND OWNER FOR CONSTRUCTION OF BUILDINGS



*Issued by The American Institute of Architects  
for use when a Stipulated Sum Forms the Basis of Payment*

Approved by THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA; THE CONTRACTING PLASTERERS' AND LATHERS' INTERNATIONAL ASSOCIATION; COUNCIL OF MECHANICAL SPECIALTY CONTRACTING INDUSTRIES, INC.; THE NATIONAL BUILDING GRANITE QUARRIES ASSOCIATION, INC.; THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION; THE PAINTING AND DECORATING CONTRACTORS OF AMERICA, AND THE PRODUCERS' COUNCIL, INC.\*

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This form is to be used only with the standard general conditions of the contract for construction of buildings.

THIS AGREEMENT made the .....

day of ..... in the year Nineteen Hundred and .....

by and between .....

..... hereinafter called the Contractor, and .....

..... hereinafter called the Owner,

WITNESSETH, that the Contractor and the Owner for the considerations hereinafter named agree as follows:

## ARTICLE I. SCOPE OF THE WORK

The Contractor shall furnish all of the materials and perform all of the work shown on the Drawings and described in the Specifications entitled .....

(Here insert the caption descriptive of the work as used on the Drawings and in the other Contract Documents)

prepared by ..... acting as and in these Contract Documents entitled the Architect; and shall do everything required by this Agreement, the General Conditions of the Contract, the Specifications and the Drawings.

\* Formal approval, which has been given previous editions, has not yet been received from all of these organizations.

AGREEMENT BETWEEN CONTRACTOR AND OWNER.

Sixth Edition

Page 1.

## FORM OF AGREEMENT (CONT.)

## ARTICLE 2. TIME OF COMPLETION

The work to be performed under this Contract shall be commenced .....  
and shall be substantially completed .....  
(Here insert stipulation as to liquidated damages, if any.)

## ARTICLE 3. THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract, subject to additions and deductions provided therein, in current funds as follows: .....  
(State here the lump sum amount, unit prices, or both, as desired in individual cases.)  
.....

Where the quantities originally contemplated are so changed that application of the agreed unit price to the quantity of work performed is shown to create a hardship to the Owner or the Contractor, there shall be an equitable adjustment of the Contract to prevent such hardship.

## ARTICLE 4. PROGRESS PAYMENTS

The Owner shall make payments on account of the Contract as provided therein, as follows:

On or about the ..... day of each month ..... per cent of the value, based on the Contract prices of labor and materials incorporated in the work and of materials suitably stored at the site thereof up to the ..... day of that month, as estimated by the Architect, less the aggregate of previous payments; and upon substantial completion of the entire work, a sum sufficient to increase the total payments to ..... per cent of the Contract price .....  
(Insert here any provision made for limiting or reducing the amount retained after the work reaches a certain stage of completion.)

## FORM OF AGREEMENT (CONT.)

## ARTICLE 5. ACCEPTANCE AND FINAL PAYMENT

Final payment shall be due ..... days after substantial completion of the work provided the work be then fully completed and the contract fully performed.

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Architect shall promptly make such inspection, and when he finds the work acceptable under the Contract and the Contract fully performed he shall promptly issue a final certificate, over his own signature, stating that the work provided for in this Contract has been completed and is accepted by him under the terms and conditions thereof, and that the entire balance found to be due the Contractor, and noted in said final certificate, is due and payable.

Before issuance of final certificate the Contractor shall submit evidence satisfactory to the Architect that all payrolls, material bills, and other indebtedness connected with the work have been paid.

If after the work has been substantially completed, full completion thereof is materially delayed through no fault of the Contractor, and the Architect so certifies, the Owner shall, upon certificate of the Architect, and without terminating the Contract, make payment of the balance due for that portion of the work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

## ARTICLE 6. THE CONTRACT DOCUMENTS

The General Conditions of the Contract, the Specifications and the Drawings, together with this Agreement, form the Contract, and they are as fully a part of the Contract as if hereto attached or herein repeated. The following is an enumeration of the Specifications and Drawings:

IN WITNESS WHEREOF the parties hereto have executed this Agreement, the day and year first above written.

## A.I.A. GENERAL CONDITIONS

A.I.A. DOCUMENT NO. A-201

(Formerly Form A2) 1958 Edition

Revised Printing, 1959

## THE AMERICAN INSTITUTE OF ARCHITECTS



# THE GENERAL CONDITIONS OF THE CONTRACT FOR THE CONSTRUCTION OF BUILDINGS

The Standard Form of General Conditions, 1958 Edition, has received the approval of THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA; THE CONTRACTING PLASTERERS' AND LATHIERS' INTERNATIONAL ASSOCIATION; COUNCIL OF MECHANICAL SPECIALTY CONTRACTING INDUSTRIES, INC.; THE NATIONAL BUILDING GRANITE QUARRIES ASSOCIATION, INC.; THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION; THE PAINTING AND DECORATING CONTRACTORS OF AMERICA; AND THE PRODUCERS' COUNCIL, INC.\*

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| 21. Owner's Right to do Work.                      | 43. Cutting, Patching.                                    |
| 22. Owner's Right to Terminate Contract.           | 44. Cleaning Up.  |

\* Formal approval, which has been given previous editions, has not yet been received from all of these organizations.

GENERAL CONDITIONS. 1958 EDITION.

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## A.I.A. GENERAL CONDITIONS (CONT.)

## ARTICLE 1

## DEFINITIONS

- a) The Contract Documents consist of the Agreement, the General Conditions of the Contract, the Supplementary General Conditions, the Drawings and Specifications, including all modifications thereof incorporated in the documents before their execution. These form the Contract.
- b) The Owner, the Contractor and the Architect are those mentioned as such in the Agreement. They are treated throughout the Contract Documents as if each were of the singular number and masculine gender.
- c) The term Subcontractor, as employed herein, includes only those having a direct contract with the Contractor and it includes one who furnishes material worked to a special design according to the plans or specifications of this work, but does not include one who merely furnishes material not so worked.
- d) Written notice shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered mail to the last business address known to him who gives the notice.
- e) The term "work" of the Contractor or Subcontractor includes labor or materials or both.
- f) All time limits stated in the Contract Documents are of the essence of the Contract.
- g) The law of the place of building shall govern the construction of this Contract.

## ARTICLE 2

## EXECUTION, CORRELATION AND INTENT OF DOCUMENTS

The Contract Documents shall be signed in duplicate by the Owner and the Contractor. In case either the Owner or Contractor or both fail to sign the General Conditions, Drawings or Specifications, the Architect shall identify them.

The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning shall be held to refer to such recognized standards.

It is not intended, that work not covered under any heading, section, branch, class or trade of the specifications, shall be supplied unless it is shown on drawings or is reasonably inferable therefrom as being necessary to produce the intended results.

## ARTICLE 3

## DETAIL DRAWINGS AND INSTRUCTIONS

The Architect shall furnish with reasonable promptness, additional instructions by means of drawings or other-

wise, necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the Contract Documents, true developments thereof, and reasonably inferable therefrom.

The work shall be executed in conformity therewith and the Contractor shall do no work without proper drawings and instructions.

Immediately after being awarded the contract the Contractor shall prepare a estimated Progress Schedule and submit same for Architect's approval. It shall indicate the dates for the starting and completion of the various stages of construction.

## ARTICLE 4

## COPIES FURNISHED

Unless otherwise provided in the Contract Documents the Contractor will be furnished, free of charge, all copies of drawings and specifications reasonably necessary for the execution of the work.

## ARTICLE 5

## SHOP DRAWINGS

The Contractor shall check and verify all field measurements and shall submit with such promptness as to cause no delay in his own work or in that of any other Contractor, three copies, checked and approved by him, of all shop or setting drawings and schedules required for the work of the various trades, and the Architect shall pass upon them with reasonable promptness, making desired corrections, including all necessary corrections relating to design and artistic effect. The Contractor shall make any corrections required by the Architect, file with him two corrected copies and furnish such other copies as may be needed. The Architect's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing called the Architect's attention to such deviations at the time of submission, and secured his written approval, nor shall it relieve him from responsibility for errors in shop drawings or schedules.

## ARTICLE 6

## DRAWINGS AND SPECIFICATIONS ON THE WORK

The Contractor shall keep one copy of all drawings and specifications on the work, in good order, available to the Architect and to his representative.

## ARTICLE 7

## OWNERSHIP OF DRAWINGS

All drawings, specifications and copies thereof furnished by the Architect are his property. They are not to be used on other work, and, with the exception of the signed Contract set, are to be returned to him on request, at the completion of the work.

## A.I.A. GENERAL CONDITIONS (CONT.)

## ARTICLE 8

## SAMPLES

The Contractor shall furnish for approval all samples as directed. The work shall be in accordance with approved samples.

## ARTICLE 9

## MATERIALS, APPLIANCES, EMPLOYEES

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation and other facilities necessary for the execution and completion of the work.

Unless otherwise specified all materials shall be new and both workmanship and materials shall be of good quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

## ARTICLE 10

## ROYALTIES AND PATENTS

The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof, except that the Owner shall be responsible for all such loss when a particular process or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has information that the process or article specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Architect or Owner.

## ARTICLE 11

## SURVEYS, PERMITS, LAWS AND REGULATIONS

The Owner shall furnish all surveys unless otherwise specified.

Permits and licenses necessary for the prosecution of the work shall be secured and paid for by the Contractor. Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the drawings and specifications are at variance therewith, he shall promptly notify the Architect in writing and any necessary changes shall be adjusted as provided in the Contract for changes in the work. If the Contractor performs any work knowing it

to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Architect, he shall bear all costs arising therefrom.

Wherever the law of the place of building requires a sales, consumer, use, or other similar tax, the Contractor shall pay such tax.

## ARTICLE 12

## PROTECTION OF WORK AND PROPERTY

The Contractor shall continuously maintain adequate protection of all his work from damage and shall protect the Owner's property from injury or loss arising in connection with this Contract. He shall make good any such damage, injury or loss, except such as may be directly due to errors in the Contract Documents or caused by agents or employees of the Owner, or due to causes beyond the Contractor's control and not to his fault or negligence. He shall adequately protect adjacent property as provided by law and the Contract Documents.

The Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of Federal, State, and Municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. He shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards for the protection of workmen and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling materials; and he shall designate a responsible member of his organization on the work, whose duty shall be the prevention of accidents. The name and position of any person so designated shall be reported to the Architect by the Contractor.

In an emergency affecting the safety of life or of the work or of adjoining property, the Contractor, without special instruction or authorization from the Architect or Owner, is hereby permitted to act, at his discretion, to prevent such threatened loss or injury, and he shall so act, without appeal, if so authorized or instructed. Any compensation, claimed by the Contractor on account of emergency work, shall be determined by agreement or Arbitration.

## ARTICLE 13

## INSPECTION OF WORK

The Architect and his representatives shall at all times have access to the work wherever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection.

If the specifications, the Architect's instructions, laws, ordinances or any public authority require any work to be specially tested or approved, the Contractor shall give the Architect timely notice of its readiness for inspection, and if the inspection is by another authority than



## A.J.A. GENERAL CONDITIONS (CONT.)

the Architect, of the data fixed for such inspection, required certificates of inspection being secured by the Contractor. Inspections by the Architect shall be promptly made, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Architect, it must, if required by the Architect, be uncovered for examination at the Contractor's expense.

Re-examination of questioned work may be ordered by the Architect and if so ordered the work must be uncovered by the Contractor. If such work be found in accordance with the Contract Documents the Owner shall pay the cost of re-examination and replacement. If such work be found not in accordance with the Contract Documents the Contractor shall pay such cost, unless it be found that the defect in the work was caused by a Contractor employed as provided in Article 35, and in that event the Owner shall pay such cost.

## ARTICLE 14

## SUPERINTENDENCE: SUPERVISION

The Contractor shall keep on his work, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Architect. The superintendent shall not be changed except with the consent of the Architect, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor. Important directions shall be confirmed in writing to the Contractor. Other directions shall be so confirmed on written request in each case.

The Contractor shall give efficient supervision to the work, using his best skill and attention. He shall carefully study and compare all drawings, specifications and other instructions and shall at once report to the Architect any error, inconsistency or omission which he may discover, but he shall not be liable to the Owner for any damage resulting from any errors or deficiencies in the contract documents or other instructions by the architect.

## ARTICLE 15

## CHANGES IN THE WORK

The Owner, without invalidating the Contract, may order extra work or make changes by altering, adding to or deducting from the work, the Contract Sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.

In giving instructions, the Architect shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purposes of the building, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order from the Owner signed or countersigned by the Architect, or a written order from the Architect stating that the Owner has authorized the extra work or change, and

no claim for an addition to the contract sum shall be valid unless so ordered.

The value of any such extra work or change shall be determined in one or more of the following ways:

- By estimate and acceptance in a lump sum.
- By unit prices named in the contract or subsequently agreed upon.
- By cost and percentage or by cost and a fixed fee.

If none of the above methods is agreed upon, the Contractor, provided he receives an order as above, shall proceed with the work. In such case and also under case (c), he shall keep and present in such form as the Architect may direct, a correct account of the cost, together with vouchers. In any case, the Architect shall certify to the amount, including reasonable allowance for overhead and profit, due to the Contractor. Pending final determination of value, payments on account of changes shall be made on the Architect's certificate.

Should conditions encountered below the surface of the ground be at variance with the conditions indicated by the drawings and specifications the contract sum shall be equitably adjusted upon claim by either party made within a reasonable time after the first observance of the conditions.

## ARTICLE 16

## CLAIMS FOR EXTRA COST

If the Contractor claims that any instructions by drawings or otherwise involve extra cost under this contract, he shall give the Architect written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property, and the procedure shall then be as provided for changes in the work. No such claim shall be valid unless so made.

## ARTICLE 17

## DEDUCTIONS FOR UNCORRECTED WORK

If the Architect and Owner deem it inexpedient to correct work injured or done not in accordance with the Contract, an equitable deduction from the contract price shall be made therefor.

## ARTICLE 18

## DELAYS AND EXTENSION OF TIME

If the Contractor be delayed at any time in the progress of the work by any act or neglect of the Owner or the Architect, or of any employee of either, or by any separate Contractor employed by the Owner, or by changes ordered in the work, or by strikes, lockouts, fire, unusual delay in transportation, unavoidable casualties or any causes beyond the Contractor's control, or by delay authorized by the Architect pending arbitration, or by any cause which the Architect shall decide to justify the delay, then the time of completion shall be extended for such reasonable time as the Architect may decide.

## A.I.A. GENERAL CONDITIONS (CONT.)

No such extension shall be made for delay occurring more than seven days before claim therefor is made in writing to the Architect. In the case of a continuing cause of delay, only one claim is necessary.

If no schedule or agreement stating the dates upon which drawings shall be furnished is made, then no claim for delay shall be allowed on account of failure to furnish drawings until two weeks after demand for such drawings and not then unless such claim be reasonable.

This article does not exclude the recovery of damages for delay by either party under other provisions in the contract documents.

## ARTICLE 19

## CORRECTION OF WORK BEFORE FINAL PAYMENT

The Contractor shall promptly remove from the premises all work condemned by the Architect as failing to conform to the Contract, whether incorporated or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the Contract and without expense to the Owner and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

If the Contractor does not remove such condemned work within a reasonable time, fixed by written notice, the Owner may remove it and may store the material at the expense of the Contractor. If the Contractor does not pay the expenses of such removal within ten days' time thereafter, the Owner may, upon ten days' written notice, sell such materials at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor.

## ARTICLE 20

## CORRECTION OF WORK AFTER FINAL PAYMENT

The Contractor shall remedy any defects due to faulty materials or workmanship and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final payment, or from the date of the Owner's substantial usage or occupancy of the project, whichever is earlier, and in accordance with the terms of any special guarantees provided in the contract. Neither the foregoing nor any provision in the contract documents, nor any special guarantee time limit, shall be held to limit the Contractor's liability for defects, to less than the legal limit of liability in accordance with the law of the place of building. The Owner shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the Architect subject to arbitration, notwithstanding final payment.

## ARTICLE 21

## THE OWNER'S RIGHT TO DO WORK

If the Contractor should neglect to prosecute the work

properly or fail to perform any provision of this contract, the Owner, after three days' written notice to the Contractor may, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor, provided, however, that the Architect shall approve both such action and the amount charged to the Contractor.

## ARTICLE 22

## OWNER'S RIGHT TO TERMINATE CONTRACT

If the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if he should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Architect, or otherwise be guilty of a substantial violation of any provision of the contract, then the Owner, upon the certificate of the Architect that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor, and his surety if any, seven days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools and appliances thereon and finish the work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price shall exceed the expense of finishing the work including compensation for additional architectural, managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred through the Contractor's default, shall be certified by the Architect.

## ARTICLE 23

## THE CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

If the work should be stopped under an order of any court, or other public authority, for a period of thirty days, through no act or fault of the Contractor or of anyone employed by him, then the Contractor may, upon seven days' written notice to the Owner and the Architect, terminate this Contract and recover from the Owner payment for all work executed and any proven loss sustained upon any plant or materials and reasonable profit and damages.

Should the Architect fail to issue any certificate for payment, through no fault of the Contractor, within seven days after the Contractor's formal request for payment or if the Owner should fail to pay to the Contractor within seven days of its maturity and presenta-

## A.I.A. GENERAL CONDITIONS (CONT.)

tion, any sum certified by the Architect or awarded by arbitrators, then the Contractor may, upon seven days' written notice to the Owner and the Architect, stop the work or terminate this Contract as set out in the preceding paragraph.

## ARTICLE 24

## APPLICATIONS FOR PAYMENTS

At least ten days before each payment falls due, the Contractor shall submit to the Architect an itemized application for payment, supported to the extent required by the Architect by receipts or other vouchers, showing payments for materials and labor, payments to subcontractors and such other evidence of the Contractor's right to payment as the Architect may direct.

If payments are made on valuation of work done, the Contractor shall, before the first application, submit to the Architect a schedule of values of the various parts of the work, including quantities, aggregating the total sum of the contract, divided so as to facilitate payments to subcontractors in accordance with Article 37(e), made out in such form as the Architect and the Contractor may agree upon, and, if required, supported by such evidence as to its correctness as the Architect may direct. This schedule, when approved by the Architect, shall be used as a basis for certificates for payment, unless it be found to be in error. In applying for payments, the Contractor shall submit a statement based upon this schedule.

If payments are made on account of materials not incorporated in the work but delivered and suitably stored at the site, or at some other location agreed upon in writing, such payments shall be conditioned upon submission by the Contractor of bills of sale or such other procedure as will establish the Owner's title to such material or otherwise adequately protect the Owner's interest including applicable insurance.

## ARTICLE 25

## CERTIFICATES FOR PAYMENTS

If the Contractor has made application for payment as above, the Architect shall, not later than the date when each payment falls due, issue a certificate for payment to the Contractor for such amount as he decides to be properly due, or state in writing his reasons for withholding a certificate.

No certificate issued nor payment made to the Contractor, nor partial or entire use or occupancy of the work by the Owner, shall be an acceptance of any work or materials not in accordance with this contract. The making and acceptance of the final payment shall constitute a waiver of all claims by the Owner, other than those arising from unsettled liens, from faulty work appearing after final payment or from requirement of drawings or specifications, and of all claims by the Contractor, except those previously made and still unsettled.

Should the Owner fail to pay the sum named in any certificate for payment issued by the Architect or in any award by arbitration, upon demand when due, the Con-

tractor shall receive, in addition to the sum named in the certificate, interest thereon at the legal rate in force at the place of building.

## ARTICLE 26

## PAYMENTS WITHHELD

The Architect may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any certificate to such extent as may be necessary to protect the Owner from loss on account of:

- Defective work not remedied.
- Claims filed or reasonable evidence indicating probable filing of claims.
- Failure of the Contractor to make payments properly to subcontractors or for material or labor.
- A reasonable doubt that the contract can be completed for the balance then unpaid.
- Damage to another Contractor.

When the above grounds are removed payment shall be made for amounts withheld because of them.

## ARTICLE 27

## CONTRACTOR'S LIABILITY INSURANCE

The Contractor shall maintain such insurance as will protect him from claims under workmen's compensation acts and other employee benefits acts, from claims for damages because of bodily injury, including death, and from claims for damages to property which may arise both out of and during operations under this Contract, whether such operations be by himself or by any subcontractor or anyone directly or indirectly employed by either of them. This insurance shall be written for not less than any limits of liability specified as part of this Contract. Certificates of such insurance shall be filed with the Owner and Architect.

## ARTICLE 28

## OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for and at his option may maintain such insurance as will protect him from his contingent liability to others for damages because of bodily injury, including death, which may arise from operations under this contract, and any other liability for damages which the Contractor is required to insure under any provision of this contract.

## ARTICLE 29

## FIRE INSURANCE WITH EXTENDED COVERAGE

Unless otherwise provided, the Owner shall effect and maintain fire insurance with extended coverage upon the entire structure on which the work of this contract is to be done to one hundred per cent of the insurable

## A.I.A. GENERAL CONDITIONS (CONT.)

value thereof, including items of labor and materials connected therewith whether in or adjacent to the structure insured, materials in place or to be used as part of the permanent construction including surplus materials, shanties, protective fences, bridges, temporary structures, miscellaneous materials and supplies incident to the work, and such scaffoldings, stagings, towers, forms, and equipment as are not owned or rented by the contractor, the cost of which is included in the cost of the work. EXCLUSIONS: This insurance does not cover any tools owned by mechanics, any tools, equipment, scaffolding, staging, towers, and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the work, or any cook shanties, bunk houses or other structures erected for housing the workmen. The loss, if any, is to be made adjustable with and payable to the Owner as Trustee for the insureds and contractors and subcontractors as their interests may appear, except in such cases as may require payment of all or a proportion of said insurance to be made to a mortgagee as his interests may appear.

Certificates of such insurance shall be filed with the Contractor if he so requires. If the Owner fails to effect or maintain insurance as above and so notifies the Contractor, the Contractor may insure his own interests and that of the subcontractors and charge the cost thereof to the Owner. If the Contractor is damaged by failure of the Owner to maintain such insurance or to so notify the Contractor, he may recover as stipulated in the contract for recovery of damages. If other special insurance not herein provided for is required by the Contractor, the Owner shall effect such insurance at the Contractor's expense by appropriate riders to his fire insurance policy. The Owner, Contractor, and all subcontractors waive all rights, each against the others, for damages caused by fire or other perils covered by insurance provided for under the terms of this contract, except such rights as they may have to the proceeds of insurance held by the Owner as Trustee.

The Owner shall be responsible for and at his option may insure against loss of use of his existing property, due to fire or otherwise, however caused. If required in writing by any party in interest, the Owner as Trustee shall, upon the occurrence of loss, give bond for the proper performance of his duties. He shall deposit any money received from insurance in an account separate from all his other funds and he shall distribute it in accordance with such agreement as the parties in interest may reach, or under an award of arbitrators appointed, one by the Owner, another by joint action of the other parties in interest, all other procedure being as provided elsewhere in the contract for arbitration. If after loss no special agreement is made, replacement of injured work shall be ordered and executed as provided for changes in the work.

The Trustee shall have power to adjust and settle any loss with the insurers unless one of the Contractors interested shall object in writing within three working days of the occurrence of loss, and thereupon arbitrators shall be chosen as above. The Trustee shall in that case make settlement with the insurers in accordance with the directions of such arbitrators, who shall also, if distribution by arbitration is required, direct such distribution.

## ARTICLE 30

## GUARANTY BONDS

The Owner shall have the right, prior to the signing of the Contract, to require the Contractor to furnish bond covering the faithful performance of the Contract and the payment of all obligations arising thereunder, in such form as the Owner may prescribe and with such sureties as he may approve. If such bond is required by instructions given previous to the submission of bids, the premium shall be paid by the Contractor; if subsequent thereto, it shall be paid by the Owner.

## ARTICLE 31

## DAMAGES

Should either party to this Contract suffer damages because of any wrongful act or neglect of the other party or of anyone employed by him, claim shall be made in writing to the party liable within a reasonable time of the first observance of such damage and not later than the final payment, except as expressly stipulated otherwise in the case of faulty work or materials, and shall be adjusted by agreement or arbitration.

## ARTICLE 32

## LIENS

Neither the final payment nor any part of the retained percentage shall become due until the Contractor, if required, shall deliver to the Owner a complete release of all liens arising out of this Contract, or receipts in full in lieu thereof and, if required in either case, an affidavit that so far as he has knowledge or information the releases and receipts include all the labor and material for which a lien could be filed; but the Contractor may, if any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

## ARTICLE 33

## ASSIGNMENT

Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the Owner.

## ARTICLE 34

## MUTUAL RESPONSIBILITY OF CONTRACTORS

Should the Contractor cause damage to any separate contractor on the work the Contractor agrees, upon due

## A.I.A. GENERAL CONDITIONS (CONT.)

notice, to settle with such contractor by agreement or arbitration, if he will so settle. If such separate contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor, who shall defend such proceedings at the Owner's expense and, if any judgment against the Owner arise therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

## ARTICLE 35

## SEPARATE CONTRACTS

The Owner reserves the right to let other contracts in connection with this work under similar General Conditions. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Architect any defects in such work that render it unsuitable for such proper execution and results. His failure so to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the other contractor's work after the execution of his work.

To insure the proper execution of his subsequent work the Contractor shall measure work already in place and shall at once report to the Architect any discrepancy between the executed work and the drawings.

## ARTICLE 36

## SUBCONTRACTS

As soon as practicable and before awarding any subcontracts, the Contractor shall notify the Architect in writing of the names of the subcontractors proposed for the principal parts of the work, and for such other parts as the Architect may direct, and shall not employ any to whom the Architect may have a reasonable objection.

If before or after the execution of the Contract, the Contractor has submitted a list of subcontractors which has been approved by the Architect, and the change of any subcontractor on such list is required by the Owner after such approval, the contract price shall be increased or decreased by the difference in cost occasioned by such change.

The Contractor shall not be required to employ any subcontractor against whom he has a reasonable objection.

The Architect shall, on request, furnish to any subcontractor, wherever practicable, evidence of the amounts certified on his account.

The Contractor agrees that he is as fully responsible to the Owner for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the Owner.

## ARTICLE 37

## RELATIONS OF CONTRACTOR AND SUBCONTRACTOR

The Contractor agrees to bind every Subcontractor and every Subcontractor agrees to be bound by the terms of the Agreement, the General Conditions of the Contract, the Supplementary General Conditions, the Drawings and Specifications as far as applicable to his work, including the following provisions of this article, unless specifically noted to the contrary in a subcontract approved in writing as adequate by the Owner or Architect.

The Subcontractor agrees—

- a) To be bound to the Contractor by the terms of the Agreement, General Conditions of the Contract, the Supplementary General Conditions, the Drawings and Specifications, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the Owner.
- b) To submit to the Contractor applications for payment in such reasonable time as to enable the Contractor to apply for payment under Article 24 of the General Conditions.
- c) To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in the General Conditions of the Contract and the Supplementary General Conditions for like claims by the Contractor upon the Owner, except that the time for making claims for extra cost is one week.

The Contractor agrees—

- d) To be bound to the Subcontractor by all the obligations that the Owner assumes to the Contractor under the Agreement, General Conditions of the Contract, the Supplementary General Conditions, the Drawings and Specifications, and by all the provisions thereof affording remedies and redress to the Contractor from the Owner.
- e) To pay the Subcontractor, upon the payment of certificates, if issued under the schedule of values described in Article 24 of the General Conditions, the amount allowed to the Contractor on account of the Subcontractor's work to the extent of the Subcontractor's interest therein.
- f) To pay the Subcontractor, upon the payment of certificates, if issued otherwise than as in (e), so that at all times his total payments shall be as large in proportion to the value of the work done by him as the total amount certified to the Contractor is to the value of the work done by him.
- g) To pay the Subcontractor to such extent as may be provided by the Contract Documents or the subcontract, if either of these provides for earlier or larger payments than the above.
- h) To pay the Subcontractor on demand for his work or materials as far as executed and fixed in place, less

## A.I.A. GENERAL CONDITIONS (CONT.)

the retained percentage, at the time the certificate should issue, even though the Architect fails to issue it for any cause not the fault of the Subcontractor.

j) To pay the Subcontractor a just share of any fire insurance money received by him, the Contractor, under Article 29 of the General Conditions.

k) To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specifically named in the subcontract.

l) That no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten days of the calendar month following that in which the claim originated.

m) To give the Subcontractor an opportunity to be present and to submit evidence in any arbitration involving his rights.

n) To name as arbitrator under arbitration proceedings as provided in the General Conditions the person nominated by the Subcontractor, if the sole cause of dispute is the work, materials, rights or responsibilities of the Subcontractor; or, if of the Subcontractor and any other subcontractor jointly, to name as such arbitrator the person upon whom they agree.

The Contractor and the Subcontractor agree that—

o) In the matter of arbitration, their rights and obligations and all procedure shall be analogous to those set forth in this contract; provided, however, that a decision by the Architect shall not be a condition precedent to arbitration.

Nothing in this article shall create any obligation on the part of the Owner to pay or to see to the payment of any sums to any subcontractor.

## ARTICLE 38

## ARCHITECT'S STATUS

The Architect shall have general supervision and direction of the work. He is the agent of the Owner only to the extent provided in the Contract Documents and when in special instances he is authorized by the Owner so to act, and in such instances he shall, upon request, show the Contractor written authority. He has authority to stop the work whenever such stoppage may be necessary to insure the proper execution of the Contract.

As the Architect is, in the first instance, the interpreter of the conditions of the Contract and the judge of its performance, he shall side neither with the Owner nor with the Contractor, but shall use his powers under the contract to enforce its faithful performance by both.

In case of the termination of the employment of the Architect, the Owner shall appoint a capable and reputable Architect against whom the Contractor makes no reasonable objection, whose status under the contract shall be that of the former Architect; any dispute in connection with such appointment shall be subject to arbitration.

## ARTICLE 39

## ARCHITECT'S DECISIONS

The Architect shall, within a reasonable time, make decisions on all claims of the Owner or Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the Contract Documents.

The Architect's decisions, in matters relating to artistic effect, shall be final, if within the terms of the Contract Documents.

Except as above or as otherwise expressly provided in the Contract Documents, all the Architect's decisions are subject to arbitration.

If, however, the Architect fails to render a decision within ten days after the parties have presented their evidence, either party may then demand arbitration. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not disturb or interrupt such proceedings except where such decision is acceptable to the parties concerned.

## ARTICLE 40

## ARBITRATION

All disputes, claims or questions subject to arbitration under this contract shall be submitted to arbitration in accordance with the provisions, then obtaining, of the Standard Form of Arbitration Procedure of The American Institute of Architects, and this agreement shall be specifically enforceable under the prevailing arbitration law, and judgment upon the award rendered may be entered in the court of the forum, state or federal, having jurisdiction. It is mutually agreed that the decision of the arbitrators shall be a condition precedent to any right of legal action that either party may have against the other.

The Contractor shall not cause a delay of the work during any arbitration proceedings, except by agreement with the Owner.

Notice of the demand for arbitration of a dispute shall be filed in writing with the other party to the contract, and a copy filed with the Architect. The demand for arbitration shall be made within a reasonable time after the dispute has arisen; in no case, however, shall the demand be made later than the time of final payment, except as otherwise expressly stipulated in the contract.

The arbitrators, if they deem that the case requires it, are authorized to award to the party whose contention is sustained, such sums as they or a majority of them shall deem proper to compensate him for the time and expense incident to the proceeding and, if the arbitration was demanded without reasonable cause, they may also award damages for delay. The arbitrators shall fix their own compensation, unless otherwise provided by agreement, and shall assess the costs and charges of the proceedings upon either or both parties.

## A.I.A. GENERAL CONDITIONS (CONT.)

## ARTICLE 41

## CASH ALLOWANCES

The Contractor shall include in the contract sum all allowances named in the Contract Documents and shall cause the work so covered to be done by such contractors and for such sums as the Architect may direct, the contract sum being adjusted in conformity therewith. The Contractor declares that the contract sum includes such sums for expenses and profit on account of cash allowances as he deems proper. No demand for expenses or profit other than those included in the contract sum shall be allowed. The Contractor shall not be required to employ for any such work persons against whom he has a reasonable objection.

## ARTICLE 42

## USE OF PREMISES

The Contractor shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the Architect and shall not unreasonably encumber the premises with his materials.

The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.

The Contractor shall enforce the Architect's instructions regarding signs, advertisements, fires and smoking.

## ARTICLE 43

## CUTTING, PATCHING

The Contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other contractors shown upon, or reasonably implied by, the Drawings and Specifications for the completed structure, and he shall make good after them as the Architect may direct.

Any cost caused by defective or ill-timed work shall be borne by the party responsible therefor.

The Contractor shall not endanger any work by cutting, excavating or otherwise altering the work and shall not cut or alter the work of any other contractor save with the consent of the Architect.

## ARTICLE 44

## CLEANING UP

The Contractor shall at all times keep the premises free from accumulations of waste materials or rubbish caused by his employees or work, and at the completion of the work he shall remove all his rubbish from and about the building and all his tools, scaffolding and surplus materials and shall leave his work "broom-clean" or its equivalent, unless more exactly specified. In case of dispute the Owner may remove the rubbish and charge the cost to the several contractors as the Architect shall determine to be just.

## PERFORMANCE BOND FORM

A.I.A. DOCUMENT NO. A-311

(Formerly Form 107) 1958 Edition

## PERFORMANCE BOND



*This document approved and issued by The American Institute of Architects  
1735 New York Avenue, N. W., Washington 6, D. C.*

## KNOW ALL MEN BY THESE PRESENTS:

That .....  
(Here insert the name and address or legal title of the Contractor)

as Principal, hereinafter called Contractor, and .....  
(Here insert the legal title of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto .....  
(Here insert the name and address or legal title of the Owner)

as Obligor, hereinafter called Owner, in the amount of ..... Dollars (\$.....),  
for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated .....  
entered into a contract with Owner for .....

in accordance with drawings and specifications prepared by .....  
(Here insert full name and title)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.



## PERFORMANCE BOND FORM (CONT.)

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the Owner.

Whenever Contractor shall be, and declared by Owner to be in default under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly

1) Complete the Contract in accordance with its terms and conditions, or

2) Obtain a bid or bids for submission to Owner for completing the Contract in accordance with its terms and conditions, and upon determination by Owner and Surety of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this

paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of Owner.

Signed and sealed this ..... day of ..... A.D. 195.....

## IN THE PRESENCE OF:

{	.....	(Principal)	(Seal)
	.....	(Title)	
{	.....	(Surety)	(Seal)
	.....	(Title)	

A.I.A. Form A-311 LABOR AND MATERIAL PAYMENT BOND FORM

## LABOR AND MATERIAL PAYMENT BOND



*This document approved and issued by The American Institute of Architects  
1735 New York Avenue, N. W., Washington 6, D. C.*

Note: This bond is issued simultaneously with another bond in favor of the owner conditioned for the full and faithful performance of the contract.

## KNOW ALL MEN BY THESE PRESENTS:

That .....  
(Here insert the name and address or legal title of the Contractor)

as Principal, hereinafter called Principal, and .....

(Here insert the legal title of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto .....

(Here insert the name and address or legal title of the Owner)

as Obligee, hereinafter called Owner, for the use and benefit of claimants as hereinbelow defined, in the

amount of ..... Dollars (\$.....),

(Here insert a sum equal to at least one-half of the contract price)

for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has by written agreement dated .....

entered into a contract with Owner for .....

in accordance with drawings and specifications prepared by .....

(Here insert full name and title)

which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

## LABOR AND MATERIAL PAYMENT BOND FORM (CONT.)

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant.

a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: The Principal, the Owner, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name

of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

b) After the expiration of one (1) year following the date on which Principal ceased work on said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

Signed and sealed this ..... day of ..... A.D. 195.....

IN THE PRESENCE OF:

{	.....	(Principal)	(Seal)
	.....	(Title)	
{	.....	(Surety)	(Seal)
	.....	(Title)	

## CHANGE ORDER FORM

**CHANGE ORDER**AIA  
FORM  
G-701

OWNER'S COPY

If this order is satisfactory, the owner is requested to please sign and return Contractor's and Architect's copies to the Architect.

ARCHITECT'S JOB No. \_\_\_\_\_

CHANGE ORDER No. \_\_\_\_\_

ISSUED DATE \_\_\_\_\_ 19\_\_\_\_

AMOUNT (Plus or Minus) \$ \_\_\_\_\_

TO \_\_\_\_\_ CONTRACTOR

FOR \_\_\_\_\_ IN CONNECTION WITH \_\_\_\_\_

FOR OWNER \_\_\_\_\_

YOUR PROPOSAL FOR MAKING THE FOLLOWING CHANGES HAS BEEN ACCEPTED:

THE AMOUNT OF THE CONTRACT WILL BE (INCREASED) (DECREASED) IN THE SUM OF:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_)

WITH (INCREASE) (DECREASE) (NO CHANGE) IN THE CONTRACT TIME OF \_\_\_\_\_ DAYS

OWNER'S APPROVAL \_\_\_\_\_ ARCHITECT

DATE \_\_\_\_\_ 19\_\_\_\_ By \_\_\_\_\_

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## CERTIFICATE FOR PAYMENT

**CERTIFICATE  
FOR PAYMENT**AIA  
FORM  
G-703

OWNER'S COPY

ARCHITECT'S JOB No. \_\_\_\_\_

TO \_\_\_\_\_ OWNER

CERTIFICATE No. \_\_\_\_\_

DATE \_\_\_\_\_ 19\_\_\_\_

**THIS IS TO CERTIFY** THAT IN ACCORDANCE WITH YOUR CONTRACT DATED \_\_\_\_\_ 19\_\_\_\_

CONTRACTOR

FOR \_\_\_\_\_ IS ENTITLED TO THE \_\_\_\_\_ PAYMENT

WHICH IS FOR THE PERIOD \_\_\_\_\_ 19\_\_\_\_ THROUGH \_\_\_\_\_ 19\_\_\_\_ IN THE AMOUNT OF:

DOLLARS (\$ \_\_\_\_\_)

THE PRESENT STATUS OF THE ACCOUNT FOR THE ABOVE CONTRACT IS AS FOLLOWS:

**ORIGINAL CONTRACT SUM** ..... \$ \_\_\_\_\_

		ADDITIONS		DEDUCTIONS	
CHANGE ORDERS APPROVED IN PREVIOUS MONTH'S BY OWNER	TOTAL	\$		\$	
CHANGE ORDER No. _____ APPROVED _____ 19____	19____				
CHANGE ORDER No. _____ APPROVED _____ 19____	19____				
CHANGE ORDER No. _____ APPROVED _____ 19____	19____				
CHANGE ORDER No. _____ APPROVED _____ 19____	19____				
CHANGE ORDER No. _____ APPROVED _____ 19____	19____				
CHANGE ORDER No. _____ APPROVED _____ 19____	19____				
<b>TOTALS</b>		\$		\$	

TOTAL ADDITIONS \$ \_\_\_\_\_

SUB TOTAL \$ \_\_\_\_\_

TOTAL DEDUCTIONS \$ \_\_\_\_\_

REMARKS

**TOTAL AMOUNT OF CONTRACT TO DATE** \$ \_\_\_\_\_

WORK STILL TO FINISH (THIS DATE) . . . . \$ \_\_\_\_\_

DUE CONTRACTOR TO DATE . . . . . \$ \_\_\_\_\_

LESS RETAINAGE % . . . . . \$ \_\_\_\_\_

TOTAL TO BE DRAWN (TO DATE) . . . . . \$ \_\_\_\_\_

CERTIFICATES PREVIOUSLY ISSUED . . . . . \$ \_\_\_\_\_

**THIS CERTIFICATE** . . . . . \$ \_\_\_\_\_

\$ \_\_\_\_\_

This is to certify that all bills are paid for which previous certificates for payment were issued.

This certificate is based on the estimated amount of work completed in the period covered and any retainage shown is deducted therefrom.

This certificate is not negotiable. It is payable only to the payee named herein and its issuance, payment and acceptance are without prejudice to any rights of the Owner or Contractor under their contract.

CONTRACTOR

ARCHITECT

PER \_\_\_\_\_ DATE \_\_\_\_\_ 19\_\_\_\_

By \_\_\_\_\_

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## PART II

### General Conditions and Specific Trades as Related to Specification Writing for Nonfireproof Types of Construction

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## CHAPTER 11

### General Conditions

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#### 11-1 GENERAL

- a. The *General Conditions* section of a set of specifications is a section including general paragraphs affecting all Subcontractors and general paragraphs affecting only the General Contractor. The *General Conditions* section particularly establishes legal responsibility and relationships of all parties involved in the work.
- b. It would require much study, writing and typing to prepare all the paragraphs necessary for a good *General Conditions* section for each set of specifications. Paragraphs have been evolved through the years to outline standard practice of the relationship and responsibilities of Owner, Architect, Contractor and Subcontractors. The American Institute of Architects has developed a standard document entitled "*The General Conditions of the Contract for the Construction of Buildings*," a reprint of which is included as Appendix 10-8. Since most Contractors are familiar with the requirements of this document, and since it has proven satisfactory for many years, it is recommended that the *A.I.A. General Conditions* be made a part of the specifications, being bound in each set. These *General Conditions* should be studied thoughtfully by everyone who writes architectural specifications.
- c. Thus, one of the first paragraphs in the *General Conditions* section of a set of specifications should state:

"The General Conditions of the Contract for the Construction of Buildings, Articles 1 through 44, a standard document of the American Institute of Architects, current edition, a copy of which is bound herein, is hereby made a part of these specifications and, except as modified and supplemented by the paragraphs herein, are the general conditions on which all contracts for this work will be based."



- d. The first portion of the specifications following the *A.I.A. General Conditions* may be entitled *Additional General Conditions*, the first paragraph of which should be Article 45, thus continuing the numerical order. This prevents any duplication of numbered articles.
- e. Knowing that most Contractors are familiar with the *A.I.A. General Conditions*, some Architects make this a part of the specifications by reference only without binding copies within the specifications. This procedure is not recommended.
- f. If this ill-advised short-cut is followed, copies of the *A.I.A. General Conditions* certainly should be bound with each set of the signed contract, or there would be an infringement, as the document is being used without any *quid pro quo* to the owner of the copyright.
- g. Certain government agencies and large corporations through their architectural and legal departments have developed their own *General Conditions* and require or recommend their use in lieu of the A.I.A. document for construction work under their jurisdiction.

#### 11-2 SHORT FORM OF CONTRACT

- a. The A.I.A. has prepared a document known as *The A.I.A. Short Form for Small Construction Contracts, Agreement and General Conditions between Contractor and Owner* (see Appendix 11-1 at the end of chapter), and recommends its use for small jobs in lieu of the longer document discussed in Paragraph 11-1 above. This short form contract is followed by 20 General Condition Articles written in a condensed form instead of the 44 more lengthy articles of the longer form.
- b. What has been said about the *A.I.A. General Conditions* also applies to this short form contract, except its use should be confined to small jobs. Since this text deals mainly with the small nonfireproof type of job such as a frame residence, the following discussions relate primarily to *The A.I.A. Short Form for Small Construction Contracts*.

#### 11-3 SCOPE

If the preamble and Article I of the Short Form Contract are filled in before they are bound with the specifications, a *Scope* paragraph is not necessary; otherwise it is important to have a *Scope* paragraph near the beginning of the *General Conditions* section of a set of specifications as suggested in Chapter 5. This paragraph should describe the following:

- 1. *Type of Work*: Whether construction is new work or alterations or additions to existing work.
- 2. *Number of Buildings*: One or more.
- 3. *Type of Project*: Residence, Office Building, Store Building, Warehouse, etc.

4. *Location of Project.*

5. *Owner:* Name and address.

6. *Architect:* Name and address.

#### 11-4 WORK NOT INCLUDED

If the Owner intends to negotiate a separate contract for any phase of the work, such as Painting, Plumbing, Heating or Electrical, mention should be made of its exclusion in this paragraph.

#### 11-5 PROPERTY DAMAGE INSURANCE

Article 6 of the *A.I.A. Short Form General Conditions* does not give the limits of liability insurance that the Owner and Architect would consider as being adequate protection for claims of property damage. The Contractor should be required to file with the Owner certificate for property damage insurance in the limits of \$25,000 for each accident and \$50,000 for the aggregate of operations (these limits are sometimes established \$50,000 and \$100,000).

#### 11-6 PROTECTION OF TREES AND SHRUBS

There are usually specific items needing special protection which should be mentioned. On residential sites there are often valuable trees and shrubs near construction operations which the Architect may wish protected from damage by adequate wood frames. These should be specified in the *General Conditions* section.

#### 11-7 PAYMENTS

Although Article 12 of the *A.I.A. Short Form General Conditions* regards payments by the Owner to the Contractor, it does not stipulate the amounts to be withheld. Since this will affect the Contractor's financing of the job, the blank spaces in the contract form should be filled in or some mention of amounts to be withheld should be made in the specifications by a paragraph such as the following:

"Monthly payments will be made to the Contractor by the Owner representing 90% of the value of the work based on the contract prices of labor and materials incorporated in the structure, and of materials suitably stored at the site thereof. Final payments in full will be due 10 days after completion of the work."

#### 11-8 CONTRACTOR'S INSURANCE

a. Article 13 of the *A.I.A. Short Form General Conditions* does not give the limits of the types of insurance that the Owner and Architect would

consider as being adequate protection from claims. Therefore, paragraphs should establish the kinds and amounts of insurance that the Contractor shall maintain. The Contractor should be required to file with the Owner certificates for insurance as follows:

1. *Workmen's Compensation Insurance* as required by law.
  2. *Public Liability Insurance* for bodily injury in the amounts of not less than \$50,000 for any one person and \$100,000 for several persons. (The amounts mentioned above are the lowest recommended. They are sometimes written \$100,000 and \$300,000 for small jobs and \$200,000 and \$500,000 for large jobs.)
- b. In some locations other insurance may be needed such as extended coverage, tornado, etc., and should be required by the specifications.

#### 11-9 VISITING SITE

To be certain that the Contractor includes in his bid all the existing conditions at the site, it is well to note in the specifications that the Contractor is assumed to have visited the site and taken into consideration all existing conditions.

#### 11-10 LAYOUT OF WORK

The datum point and property lines usually have been (or will be) established by a survey. Before starting work the Contractor usually should be required to lay out the work and establish elevations, accurately marked on substantial batter boards. The drawings should indicate the approximate grades at the building site.

#### 11-11 MEASUREMENTS AND DIMENSIONS

Since slight deviations from the drawing dimensions often occur on work, some architects specify that in the preparation of shop drawings all measurements and dimensions shall be verified at the job. Job measurements shall govern.

#### 11-12 TAXES

The Contractor should be warned that he assumes and is liable for all State and Federal Employer's and Employee's Taxes, Sales Taxes and Withholding Taxes.

#### 11-13 ALLOWANCES

- a. There is no doubt that it expedites getting out the plans and specifications promptly to set up cash allowances instead of taking the time to select and describe some items specifically. The Owner cannot express his preference for certain items until the job is under construction, be-

cause it would require a greater ability to visualize than is ordinarily possible for the layman.

- b. Allowances to be included in the bid of the General Contractor, such as a lump sum allowance for the heating system, for landscaping or paving, should be called for under an appropriate heading in the *General Conditions* section.
- c. Allowances to be included in the bids of the Subcontractors to the General Contractor should be covered in the respective trade sections. For residential work there are usually:
  - 1. Allowance for Bath Room accessories, including medicine cabinets, set up in the *Tile Work* section.
  - 2. Allowance for finish hardware, not otherwise specified, set up in the *Finish Carpentry* section.
  - 3. Allowance for lighting fixtures set up in the *Electrical* section.
  - 4. Kitchen cabinets of wood (or metal) including counter top set up in the *Finish Carpentry* section.
  - 5. Fireplace hearths and facings of marble set up in the *Tile Work* section.
  - 6. Fireplace mantels, when stock mantels are to be used, set up in the *Finish Carpentry* section.

#### 11-14 PERFORMANCE BOND (Appendix 10-9)

If it is known at the time specifications are being prepared that a performance bond will be required by the Owner, the performance bond should be specified. Mention should be made that the bond shall cover 100% of the contract price (other percentages are used for public work when prescribed by statutes) and that the Contractor instead of the Owner shall pay the premiums. An Architect should always advise the Owner to require a performance bond and leave it to the Owner to decide whether he will assume the risk involved by not requiring it.

#### 11-15 ALTERATIONS AND ADDITIONS

- a. If the job for which the specifications are written is alterations or additions to existing buildings, the Contractor should be warned that new work in extension of existing work should match such work in all respects, except where otherwise indicated or specified. Matching brick, stone, etc. may be difficult to secure and should be called to the Contractor's attention during the estimating period.
- b. For alterations and addition work some mention should be made that old work cut, altered or temporarily removed and replaced, and all work remaining in place but damaged or defaced by reasons of the work done under the Contract should be restored to its original condition. If re-

removal of existing work exposes discolored or unfinished surfaces, or work out of alignment, or unsuitable materials, such surfaces should be refinished or materials replaced as necessary to make the work uniform.

#### 11-16 REUSING EXISTING MATERIALS

For alterations and addition work the following paragraph is also suggested:

*"Reusing Existing Materials:* Materials removed from the existing building, if suitable, may be reused in the new work. Existing materials for reuse in unexposed work shall be substantial enough to produce the strength required and existing materials for reuse in exposed work shall be capable of being finished to match the new work. Materials of value taken from the work now in place shall remain the property of the Owner. All other materials taken from the work shall be removed from the premises and disposed of by the Contractor."

#### 11-17 DEMOLITION

If the job includes extensive demolition, the following paragraph can be inserted:

*"Demolition:* Demolish all portions of the existing building indicated to be removed on the drawings. Remove windows and doors where noted. Cut new openings and fill existing openings where shown. Broken lines on the drawings indicate partitions and walls to be removed or demolished."

#### 11-18 SUMMARY

In writing specifications and particularly the *General Conditions* section, it must be remembered that the Architect should be fair to both the Owner and the Contractor. The responsibility of each must be clearly defined and no attempt made to hinder the Contractor by undue restrictions or "weasel" clauses.

On small jobs the *General Conditions of the A.I.A. Short Form Contract*, and on larger work the *A.I.A. General Conditions of the Contract for the Construction of Buildings*, should be used and made a part of the specifications as outlined in this chapter.

## SHORT FORM FOR SMALL CONSTRUCTION CONTRACTS

A.I.A. DOCUMENT NO. A-107

Formerly 307

## A.I.A. SHORT FORM FOR SMALL CONSTRUCTION CONTRACTS

# AGREEMENT AND GENERAL CONDITIONS BETWEEN CONTRACTOR AND OWNER



Issued by The American Institute of Architects for use only when the proposed work is simple in character, small in cost, and when a stipulated sum forms the basis of payment. For other contracts the Institute issues the standard form of agreement between Contractor and Owner for construction of buildings and the standard general conditions in connection therewith for use when a stipulated sum forms the basis for payment.

1958 edition, copyright, 1936-1951 © 1958 by The American Institute of Architects, The Octagon, Washington, D. C.

THIS AGREEMENT made the .....

day of ..... in the year Nineteen Hundred and .....

by and between .....

..... hereinafter called the Contractor, and

..... hereinafter called the Owner.

WITNESSETH, That the Contractor and the Owner for the considerations hereinafter named agree as follows:

ARTICLE 1. SCOPE OF THE WORK—The Contractor shall furnish all of the material and perform all of the work for ..... as shown

(Caption indicating the portion or portions of work covered)

on the drawings and described in the specifications entitled .....

prepared by ..... Architect

all in accordance with the terms of the contract documents.

ARTICLE 2. TIME OF COMPLETION—The work shall be substantially completed .....

### SHORT FORM FOR SMALL CONSTRUCTION CONTRACTS (CONT.)

ARTICLE 3. CONTRACT SUM—The Owner shall pay the Contractor for the performance of the contract subject to the additions and deductions provided therein in current funds, the sum of ..... dollars. (\$.....)

ARTICLE 4. PROGRESS PAYMENTS—The Owner shall make payments on account of the contract, upon requisition by the Contractor, as follows:

ARTICLE 5. ACCEPTANCE AND FINAL PAYMENT—Final payment shall be due ..... days after completion of the work, provided the contract be then fully performed, subject to the provisions of Article 16 of the General Conditions.

ARTICLE 6. CONTRACT DOCUMENTS—Contract Documents are as noted in Article 1 of the General Conditions. The following is an enumeration of the drawings and specifications:

### GENERAL CONDITIONS

#### ARTICLE 1

##### CONTRACT DOCUMENTS

The contract includes the AGREEMENT and its GENERAL CONDITIONS the DRAWINGS, and the SPECIFICATIONS. Two or more copies of each, as required, shall be signed by both parties and one signed copy of each retained by each party.

The intent of these documents is to include all labor, materials, appliances and services of every kind necessary for the proper execution of the work, and the terms and conditions of payment therefor.

The documents are to be considered as one, and whatever is called for by any one of the documents shall be as binding as if called for by all.

#### ARTICLE 2

##### SAMPLES

The Contractor shall furnish for approval all samples

as directed. The work shall be in accordance with approved samples.

#### ARTICLE 3

##### MATERIALS, APPLIANCES, EMPLOYEES

Except as otherwise noted, the Contractor shall provide and pay for all materials, labor, tools, water, power and other items necessary to complete the work.

Unless otherwise specified, all materials shall be new, and both workmanship and materials shall be of good quality.

All workmen and sub-contractors shall be skilled in their trades.

#### ARTICLE 4

##### ROYALTIES AND PATENTS

The Contractor shall pay royalties and license fees. He

## SHORT FORM FOR SMALL CONSTRUCTION CONTRACTS (CONT.)

shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.

## ARTICLE 5

## SURVEYS, PERMITS, AND REGULATIONS

The Owner shall furnish all surveys unless otherwise specified. Permits and licenses necessary for the prosecution of the work shall be secured and paid for by the Contractor. Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall comply with all laws and regulations bearing on the conduct of the work and shall notify the Owner if the drawings and specifications are at variance therewith.

## ARTICLE 6

## PROTECTION OF WORK, PROPERTY, AND PERSONS

The Contractor shall adequately protect the work, adjacent property and the public and shall be responsible for any damage or injury due to his act or neglect.

## ARTICLE 7

## INSPECTION OF WORK

The Contractor shall permit and facilitate inspection of the work by the Owner and his agents and public authorities at all times.

## ARTICLE 8

## CHANGES IN THE WORK

The Owner may order changes in the work, the Contract Sum being adjusted accordingly. All such orders and adjustments shall be in writing. Claims by the Contractor for extra cost must be made in writing before executing the work involved.

## ARTICLE 9

## CORRECTION OF WORK

The Contractor shall re-execute any work that fails to conform to the requirements of the contract and that appears during the progress of the work, and shall remedy any defects due to faulty materials or workmanship which appear within a period of one year from the date of completion of the contract. The provisions of this article apply to work done by subcontractors as well as to work done by direct employees of the Contractor.

## ARTICLE 10

## OWNER'S RIGHT TO TERMINATE THE CONTRACT

Should the Contractor neglect to prosecute the work properly, or fail to perform any provision of the contract, the Owner, after seven days' written notice to the Contractor, may, without prejudice to any other remedy he may have, make good the deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor or, at his option, may terminate the contract and take possession of all materials, tools, and appliances and finish the work by such means as he sees fit, and if the unpaid balance of the contract price exceeds the expense of finishing the work, such excess shall be paid to the Contractor, but if such expense exceeds such unpaid balance, the Contractor shall pay the difference to the Owner.

## ARTICLE 11

## CONTRACTOR'S RIGHT TO TERMINATE CONTRACT

Should the work be stopped by any public authority for a period of thirty days or more, through no fault of the Contractor, or should the work be stopped through act or neglect of the Owner for a period of seven days, or should the Owner fail to pay the Contractor any payment within seven days after it is due, then the Contractor upon seven days' written notice to the Owner, may stop work or terminate the contract and recover from the Owner payment for all work executed and any loss sustained and reasonable profit and damages.

## ARTICLE 12

## PAYMENTS

Payments shall be made as provided in the Agreement. The making and acceptance of the final payment shall constitute a waiver of all claims by the Owner, other than those arising from unsettled liens or from faulty work appearing thereafter, as provided for in Article 9, and of all claims by the Contractor except any previously made and still unsettled. Payments otherwise due may be withheld on account of defective work not remedied, liens filed, damage by the Contractor to others not adjusted, or failure to make payments properly to subcontractors or for material or labor.

## ARTICLE 13

## CONTRACTOR'S LIABILITY INSURANCE

The Contractor shall maintain such insurance as will protect him from claims under workmen's compensation acts and from claims for damages because of bodily injury, including death, which may arise both out of and during operations under this contract, whether such operations be by himself or by any subcontractor or anyone directly or indirectly employed by either of them. This insurance shall be written for not less than any



## SHORT FORM FOR SMALL CONSTRUCTION CONTRACTS (CONT.)

limits of liability specified as part of this contract. This insurance need not cover any liability imposed by Article 6 of the General Conditions. Certificates of such insurance shall be filed with the Owner and architect.

### ARTICLE 14

#### OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for and at his option may maintain such insurance as will protect him from his contingent liability to others for damages because of bodily injury, including death, which may arise from operations under this contract, and any other liability for damages which the Contractor is required to insure under any provision of this contract.

### ARTICLE 15

#### FIRE INSURANCE WITH EXTENDED COVERAGE

The Owner shall effect and maintain fire insurance with extended coverage upon the entire structure on which the work of this contract is to be done to one hundred per cent of the insurable value thereof, including items of labor and materials connected therewith whether in or adjacent to the structure insured, materials in place or to be used as part of the permanent construction including surplus materials, shanties, protective fences, bridges, temporary structures, miscellaneous materials and supplies incident to the work, and such scaffoldings, stagings, towers, forms, and equipment as are not owned or rented by the contractor, the cost of which is included in the cost of the work. **EXCLUSIONS:** The insurance does not cover any tools owned by mechanics, any tools, equipment, scaffolding staging, towers, and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the work, or any cook shanties, bunk houses or other structures erected for housing the workmen. The loss, if any, is to be made adjustable with and payable to the Owner as Trustee for the insureds and contractors and subcontractors as their interests may appear, except in such cases as may require payment of all or a proportion of said insurance to be made to a mortgagee as his interests may appear.

Certificates of such insurance shall be filed with the Contractor if he so requires. If the Owner fails to effect or maintain insurance as above and so notifies the Contractor, the Contractor may insure his own interests and that of the subcontractors and charge the cost thereof to the Owner. If the Contractor is damaged by failure of the Owner to maintain such insurance or to so notify the Contractor, he may recover as stipulated in the contract for recovery of damages. If other special insurance not herein provided for is required by the Contractor, the Owner shall effect such insurance at the Contractor's expense by appropriate riders to his fire insurance policy. The Owner, Contractor, and all subcontractors waive all rights, each against the others, for damages caused by fire or other perils covered by insurance provided for under the terms of this contract, except such rights as they may have to the proceeds of insurance held by the Owner as Trustee.

The Owner shall be responsible for and at his option may insure against loss of use of his existing property, due to fire or otherwise, however caused.

If required in writing by any party in interest, the Owner as Trustee shall, upon the occurrence of loss, give bond for the proper performance of his duties. He shall deposit any money received from insurance in any account separate from all his other funds and he shall distribute it in accordance with such agreement as the parties in interest may reach or under an award of arbitrators appointed, one by the Owner, another by joint action of the other parties in interest, all other procedure being as provided elsewhere in the contract for arbitration. If after loss no special agreement is made, replacement of injured work shall be ordered and executed as provided for changes in the work.

The Trustee shall have power to adjust and settle any loss with the insurers unless one of the Contractors interested shall object in writing within three working days of the occurrence of loss, and thereupon arbitrators shall be chosen as above. The Trustee shall in that case make settlement with the insurers in accordance with the directions of such arbitrators, who shall also, if distribution by arbitration is required, direct such distribution.

### ARTICLE 16

#### LIENS

The final payment shall not be due until the Contractor has delivered to the Owner a complete release of all liens arising out of this contract, or receipts in full covering all labor and materials for which a lien could be filed, or a bond satisfactory to the Owner indemnifying him against any lien.

### ARTICLE 17

#### SEPARATE CONTRACTS

The Owner has the right to let other contracts in connection with the work and the Contractor shall properly cooperate with any such other contractors.

### ARTICLE 18

#### THE ARCHITECT'S STATUS

The Architect shall have general supervision of the work. He has authority to stop the work if necessary to insure its proper execution. He shall certify to the Owner when payments under the contract are due and the amounts to be paid. He shall make decisions on all claims of the Owner or Contractor. All his decisions are subject to arbitration.

### ARTICLE 19

#### ARBITRATION

Any disagreement arising out of this contract or from the breach thereof shall be submitted to arbitration, and

## SHORT FORM FOR SMALL CONSTRUCTION CONTRACTS (CONT.)

judgment upon the award rendered may be entered in the court of the forum, state or federal, having jurisdiction. It is mutually agreed that the decision of the arbitrators shall be a condition precedent to any right of legal action that either party may have against the other. The arbitration shall be held under the Standard Form of Arbitration Procedure of The American Institute of Architects or under the Rules of the American Arbitration Association.

## ARTICLE 20

## CLEANING UP

The Contractor shall keep the premises free from accumulation of waste material and rubbish and at the completion of the work he shall remove from the premises all rubbish, implements and surplus materials and leave the building broom-clean.

IN WITNESS WHEREOF the parties hereto executed this Agreement, the day and year first above written.

Contractor .....

Owner .....

## CHAPTER 12

### Earth Work

---

#### 12-1 GENERAL

Test borings are generally made and the character of the earth established before working drawings are prepared for large construction projects, but on residential and other small work this is not often done. Specifications should be drawn up in a manner to take care of contingencies below the surface unless local character of the earth is generally known. A Contractor should not be forced to assume the risk of encountering poor soil or masses of rock below the surface of the ground.

#### 12-2 CLEARING SITE

A specification paragraph should instruct Contractor to cut down and otherwise remove trees and shrubs within building lines (or within 5 ft. of building lines) and within lines of all walks, terraces and driveways. Contractor should also remove trees indicated to be removed on Plot Plan. Rubbish caused by the cutting of trees and shrubs should be removed from job site.

#### 12-3 CUTTING TREES

Often the Owner wants the trees cut into fire logs to be saved for use in a fireplace. If this is true, the specifications should call for Contractor to cut trees into fire logs not over 2' 6" long (or a longer or shorter length to fit the specific fireplace). These should be neatly stacked on property for Owner's future use. At any rate, the specifications should make it definite whether the Owner or the Contractor is to dispose of the tree trunks (particularly if there is any possibility of lumber value of the trees).

#### 12-4 TREE STUMPS

Tree stumps foster termites and, therefore, the specifications should mention that tree stumps should be removed except those outside of the building lines or paved areas which will be 1' 0" or more below grade.

### 12-5 TOPSOIL

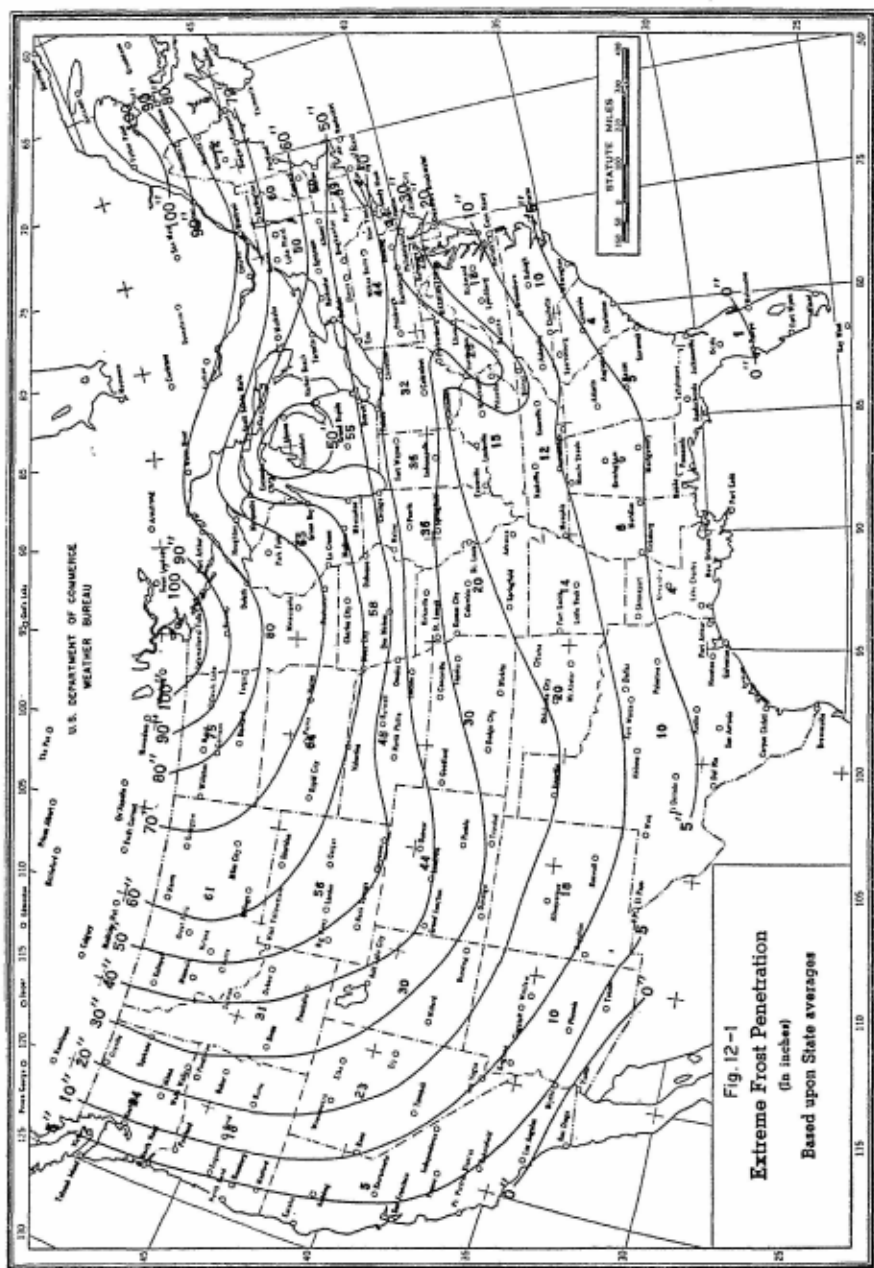
It is advisable to conserve good topsoil on the site of the job, for topsoil is developed by nature over a period of many years. The specification writer may stipulate topsoil should be stripped from the areas to be excavated and graded and be neatly piled on the property; then, after backfilling is finished and areas graded, the available topsoil should be spread over the areas. On jobs where topsoil is buried or dispersed, the Owner is put to the additional expense of purchasing topsoil for landscaping his property.

### 12-6 GENERAL EXCAVATION

In earth work the term *general excavation* usually refers to that portion of the excavation accomplished by drag pans, power shovels, or other mechanical means, while other excavation done by hand is usually termed *footing excavation* or *trench excavation*. The Contractor should be informed that all excavation is to be done as indicated on the drawings and with sufficient working space to permit the placing, inspection and completion of all work. If the specification is written for a frame type building, it should also be noted that ground level in *unexcavated portions* shall be at least 18" from the bottom of wood joists (sometimes this is specified to be 24"). This space under joists serves as a crawl space for access to plumbing pipes, heating pipes or ducts and electrical conduit; it keeps lumber farther away from termite infected earth and facilitates ventilation.

### 12-7 FOOTING EXCAVATION

- a. The Contractor should be directed to excavate for foundation wall, pier and chimney footings. For particular types of soil, it may be specified that side forms may be omitted and the trenches cut to accurate sizes to serve as the forms. The bottom of footings should be level, and the depth of the footings should also be established by the specifications; this depth is usually controlled by local building codes and is based upon the average frost penetration line in different sections of the country. Footings should be at least 18" below the finish grade even in high frost line states. (See Figure 12-1 for penetration in inches in the various states.) Unless the footings are below the frost line, there is the possibility that frost action will soften soil under the footings and cause settling of the building.
- b. In cold regions, the footings have to be taken very deep and it is understandable that houses have full basements without too much additional expense. In warmer climates there may be only partial basements or none at all unless extra expense is deliberately incurred.
- c. If the specification writer is not sure the soil will be firm enough at the depths shown on the drawings, or at the depths specified, he should state



in his paragraph that if the foundation is not sufficiently firm at the depths shown or specified, the Architect is to be notified. If the Contractor is ordered to extend footings deeper, he should receive extra compensation on a unit cost basis.

#### 12-8 TRENCH EXCAVATION

Trench excavation and all other excavation required for plumbing, heating and electrical work is generally excluded from the *Earth Work* section since this excavation is made the responsibility of the individual trades involved.

#### 12-9 ROCK EXCAVATION

In certain localities one may be sure no rock will be encountered in the earth work, but, in other parts of the country, rock is prevalent. The specification writer should provide for the contingency of encountering rock in pieces greater than 9 cu. ft. (sometimes  $\frac{1}{2}$  cu. yd.) which require the use of air-hammer for removal. Then the Contractor should notify the Architect before removal, and if the Contractor is ordered to remove the rock, extra compensation should be allowed, based on a unit cost. It always costs the Contractor more to remove the stone or boulders where it cannot be accomplished by drag pan or power shovel; thus, it is only fair that a paragraph of this nature should be included in the *Earth Work* section. Blasting to remove rock should not be used except as a last resort.

#### 12-10 UNIT COST

To take care of footing and rock excavation as outlined, the specification should instruct the Contractor to state in his bid the unit cost per cu. yd. of footing excavation and the cost per cu. yd. of rock excavation requiring the use of air-hammer. The unit cost for rock should represent the difference between earth excavation and rock excavation cost per cu. yd.

#### 12-11 EXCESS OR INSUFFICIENT MATERIAL

In contour design for any project an effort is usually made to balance the excavation and fill, thus allowing no excess or insufficient material. This balance is not always practicable. When there will be insufficient excavated material to bring the grades to those indicated on the Plot Plan, the Contractor should be instructed to furnish suitable material at no additional cost. In the event the specification writer knows there will be excess earth, he should state that this excess is to be disposed of on the property as directed by the Architect (or removed from the site of the property by the Contractor).

### 12-12 FOOTING DRAIN TILE (Figure 12-2)

In localities where water pressure might build up against the foundation walls, Architects specify drain tile around the perimeter of the building to relieve this water pressure. This tile should be of 4" agricultural drain tile with standard terra-cotta pipe fittings at corners and angles. The tile should be laid on treated plank or 3" bed of gravel just outside of the foundation wall footings and be uniformly pitched, approximately  $\frac{1}{8}$ " to the foot, to a low point indicated on the drawings. It should be specified that the tile be laid  $\frac{1}{2}$ " apart and the top of the joints covered with strips of tarred felt wired to tile with the bottom of the joints left open. The drain tile should

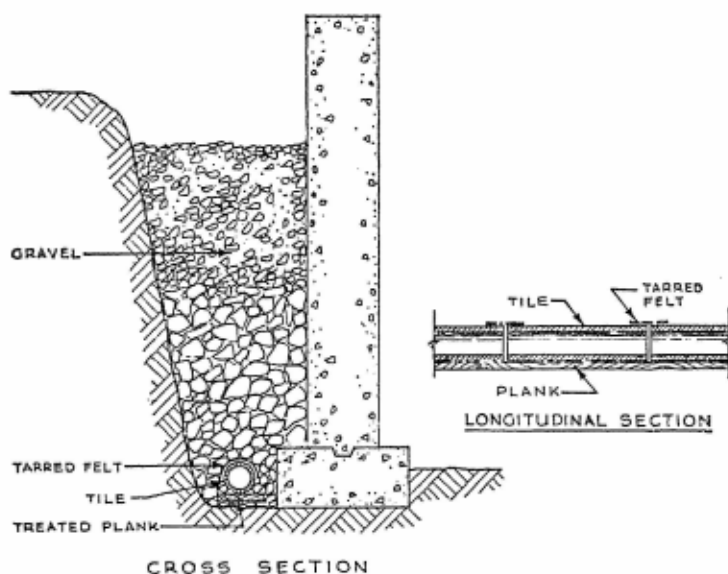


FIG. 12-2 FOOTING DRAIN TILE

be covered with gravel to a point 12" below the finish grade and this fill should be at least 18" wide. The gravel or crushed stone for this backfill may be graded from 2" to 1" for bottom third,  $1\frac{1}{2}$ " to  $\frac{3}{4}$ " for center third and  $\frac{1}{2}$ " to No. 4 for top third.

### 12-13 BACKFILLING

After a building is constructed, it is necessary to backfill around the walls. The specification writer must note that the backfilling should be of earth, free from debris, placed in horizontal layers not over 12" depth. The Contractor should be cautioned that each layer must be thoroughly tamped and puddled so that no settlement in completed work will occur. By *puddling* is

meant the adding, in puddles, of water to carry the small particles of the earth down between the larger particles of the earth. By *earth free from debris* is meant earth free from plaster, rocks, brick batts, pieces of wood, leaves and other miscellaneous matter.

#### 12-14 FILL UNDER CONCRETE SLABS

The fill under concrete slabs should be of clean earth also, and be placed in the same manner as specified for backfill except in 6" layers (sometimes 8") instead of 12" layers. Where large areas of earth are to be compacted (on large projects), special methods should be specified, similar to those included in state highway specifications, using sheep's-foot rollers and other equipment.

#### 12-15 STONE OR GRAVEL FILL

Because capillary attraction in the concrete may bring water from the earth up into the building, gravel or crushed stone fill is often specified under the concrete floor slabs. The depth of this fill is usually about 4"; it may be of crushed stone or gravel complying with ASTM Spec. C33 graded from 1" to No. 4. When the fill is placed, it should be thoroughly compacted by tamping or rolling. Vapor barrier over this fill is specified in *Concrete* section.

#### 12-16 GRADING

The general grading of a job is usually done with a drag pan, scraper, bulldozer or road grader. The specifications should state that the finish grades are to be brought to the levels shown on the drawings and should be sloped to drain water away from the building. Rough grading for paved areas should be within 0.2 ft., plus or minus, of finished subgrade elevations. The grade lines on the Plot Plan are usually shown at 1-ft. intervals, the existing grades being indicated with broken lines and the new grades with solid lines. In addition to the 1-ft. contours, elevations are written at critical points such as the corners of the building and the top and bottom of steps.



## CHAPTER 13

### Concrete

---

#### 13-1 GENERAL

- a. This chapter deals with specifications for concrete work in connection with a frame type building. It does not discuss the details of design mixes, tests, various types of floor finishes, pan type forms, and other special forms such as would be specified for reinforced concrete structures or buildings having more concrete work than an ordinary residence.
- b. Concrete is a solid material made up of graded particles (aggregates). The finer particles fall within the spaces between the coarse ones, with a cement-and-water paste filling the spaces between the particles of aggregate; all this forms a homogenous mass by chemical action.

#### 13-2 MATERIALS

- a. *Portland Cement* is made by heating a natural or artificial mixture of limestone and clay to a very high temperature and the partially vitrified material is ground to powder and mixed with a small amount of gypsum. Portland cement may be specified by brand name or merely by reference to ASTM Spec. C150 and the designation of Type I, which is the type used in general concrete construction where the special properties of the following types are not required:

*Type II:* for use in general concrete construction exposed to moderate sulfate action or where moderate heat of hydration is required.

*Type III:* for use when high early strength is required.

*Type IV:* for use when a low heat of hydration is required.

*Type V:* for use where high sulfate resistance is required.

- b. *Aggregates* are particles of inert material and are most easily specified by reference to the ASTM Spec. C33 covering both fine and coarse aggregates suitable for use in concrete.

1. *Fine Aggregate:* The ASTM Specification permits the use of natural sand or of sand prepared from stone, blast-furnace slag, gravel or other inert materials having similar characteristics. If the specification writer wishes to limit this to natural sand he should do so. The ASTM Spec. has only one grading of fine aggregate, and this is from a No. 4 to a No. 100 sieve as follows:

<i>Sieve</i>	<i>Percentage Passing</i>
$\frac{3}{8}$ "	100
No. 4 (4760-micron)	95 to 100
No. 16 (1190-micron)	50 to 85
No. 50 (297-micron)	10 to 30
No. 100 (149-micron)	2 to 10

2. *Coarse Aggregate:* The ASTM Spec. allows coarse aggregate to consist of crushed stone, gravel, or blast-furnace slag. If the specification writer wishes to accept only gravel or crushed stone, he should so specify. The size of the coarse aggregate is usually specified graded from 1" to No. 4, except coarse aggregate for topping which should be graded from  $\frac{1}{2}$ " to No. 4. The grading requirements of the ASTM Spec. are shown in Table 13-1.

TABLE 13-1. GRADING REQUIREMENTS FOR CRUSHED STONE,  
GRAVEL AND BLAST-FURNACE SLAG  
(Percentages Passing Laboratory Sieves Having Square Openings)

<i>Designated Size</i>	$2\frac{1}{2}$ "	2"	$1\frac{1}{2}$ "	1"	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$\frac{3}{8}$ "	No. 4
2" to No. 4	100	95 to 100		35 to 70		10 to 30		0 to 5
$1\frac{1}{2}$ " to No. 4		100	95 to 100		35 to 70		10 to 30	0 to 5
1" to No. 4			100	95 to 100		25 to 60		0 to 10
$\frac{3}{4}$ " to No. 4				100	90 to 100		20 to 55	0 to 10
$\frac{1}{2}$ " to No. 4					100	90 to 100	40 to 70	0 to 15
2" to 1"	100	95 to 100	35 to 70	0 to 15		0 to 50		
$1\frac{1}{2}$ " to $\frac{3}{4}$ "		100	90 to 100	20 to 55	0 to 15		0 to 5	

Source: ASTM Spec. C33.

- c. *Reinforcing Steel* bars are deformed bars (except  $\frac{1}{4}$ " bars which may be plain round) made of Intermediate Grade billet steel complying with ASTM Spec. A15 or axle steel complying with ASTM Spec. A160. The recommended sizes of reinforcing rods are shown by Table 13-2.
- d. *Welded Wire Fabric* is often used in lieu of reinforcing bars for the reinforcement in concrete slabs. It can be specified by reference to ASTM Spec. A185.
- e. *Forms:* In residential work except for garage roof slab, there is very little exposed concrete and when slabs are poured on earth probably no

TABLE 13-2. RECOMMENDED SIZES OF REINFORCING RODS  
AS ESTABLISHED BY ASTM SPECIFICATIONS

<i>Current Bar Designation</i>	<i>Sizes</i>	<i>Area—Sq. In.</i>	<i>Weight—Lb. Per Ft.</i>
No. 2	$\frac{1}{4}$ " rd.	0.05	0.167
No. 3	$\frac{3}{8}$ " rd.	0.11	0.376
No. 4	$\frac{1}{2}$ " rd.	0.20	0.668
No. 5	$\frac{5}{8}$ " rd.	0.31	1.043
No. 6	$\frac{3}{4}$ " rd.	0.44	1.502
No. 7	$\frac{7}{8}$ " rd.	0.60	2.044
No. 8	1" rd.	0.79	2.670
No. 9 rd., former	1" sq.	1.00	3.400
No. 10 rd., former	$1\frac{1}{8}$ " sq.	1.27	4.303
No. 11 rd., former	$1\frac{1}{4}$ " sq.	1.56	5.313
No. 14S	$1\frac{3}{4}$ " rd.	2.25	7.050
No. 18S	$2\frac{1}{4}$ " rd.	4.09	13.600

form material will be required. For forming up concrete, square-edged *No. 2 Boards* of Southern Pine or Douglas Fir may be used except on surfaces which will be exposed in completed work where T&G, EM, *No. 1 Boards* of Southern Pine or Douglas Fir should be specified.

For special smooth concrete finishes, as often required for commercial and industrial work, Douglas Fir Plyform  $\frac{5}{8}$ " or  $\frac{3}{4}$ " thick is often specified.

For studs and wales, *No. 2 Dimension* Southern Pine or Douglas Fir may be specified.

### 13-3 CONCRETE MIXES

- a. For construction projects involving the use of large quantities of concrete, design mixes are specified by the structural engineer. The strength, consistency and water-cement ratio of each type of mix is specified, and the design mixes are then selected from tests conducted by an independent testing laboratory.
- b. For residential work, design mixes would be too complicated for the limited work involved. If the site of the job is in a rural area it may not even be practical to specify ready-mixed concrete, which is concrete shipped from a central plant in truck mixer or agitator. In this event the specification writer should specify the concrete mixes by volume calling for a  $1:2\frac{3}{4}:4$  mix (meaning 1 sack of cement,  $2\frac{3}{4}$  cu. ft. of fine aggregate and 4 cu. ft. of coarse aggregate) for mass concrete such as footings or concrete buried in the ground and a  $1:2\frac{1}{4}:3$  mix for all other concrete.
- c. If ready-mixed concrete is available, ready-mixed concrete with a strength of at least 2,000 psi at the end of 28 days may be specified in lieu of the  $1:2\frac{3}{4}:4$  mix and ready-mixed concrete with a strength of at

least 2,500 psi at the end of 28 days may be specified in lieu of the 1:2¼:3 mix.

- d. *Water-Cement Ratio and Slump:* Since the strength of concrete in large part depends on the amount of water added, the amount of water should be limited to not over 6½ gals. per sack of cement. The workability of the concrete should also be limited by a slump not exceeding 6". The control of water and slump is more rigid on large projects than mentioned above.

### 13-4 PLACING REINFORCEMENT

It might be mentioned that reinforcing bars shall be placed accurately and secured with wire ties or clips and supported on metal or concrete chairs. No reinforcement should be permitted closer than ¾" to the surface of the concrete.

### 13-5 FOOTINGS

Soil bearing value should be determined and footings designed for the proper distribution of superimposed loads, but they should not be less than shown in Table 13-3 for average soil conditions and average loads.

- a. *Wall Footings* for a two-story frame house may be specified to be 8" thick and to project 4" on both sides of wall. If there are exceptions shown on the drawings, add "except where otherwise shown on drawings." For other types of houses, minimum footing sizes may be determined from Table 13-3.

TABLE 13-3. MINIMUM SIZE OF FOOTINGS RECOMMENDED FOR HOUSES

	<i>1-Story Frame House</i>	<i>1-Story Masonry House</i>	<i>2-Story Frame House</i>	<i>2-Story Masonry House</i>
Wall footings	6" thick 3" projection	8" thick 4" projection	8" thick 4" projection	12" thick * 6" projection
Pier footings	8" thick 4" projection min. area 3 sq. ft.	(Same as 1-Story Frame)	12" thick 6" projection min. area 4 sq. ft.	(Same as 2-Story Frame)
Column footings	12" thick 24" x 24"	(Same as 1-Story Frame)	(Same as 1-Story Frame)	(Same as 1-Story Frame)
Chimney footings	8" thick 4" projection	(Same as 1-Story Frame)	12" thick 6" projection	(Same as 2-Story Frame)

\* Or 8" thick with 4" projection if reinforced with two No. 5 (⅝") round bars 8" apart continuous.

- b. *Pier and Column Footings:* Pier footings for a 2-story frame house may be specified to be 12" thick and to project at least 6" on all sides and to have a minimum area of 4 sq. ft. Column footings for a 2-story frame house may be specified to be 12" thick and 24" x 24". If there are exceptions shown on the drawings, add "except where otherwise shown on the drawings." For the minimum size of pier and column footings for other types of houses, see Table 13-3.
- c. *Chimney Footings* for a 2-story frame house may be specified to be 12" thick and to project at least 6" on all sides. For the minimum size of chimney footings for other types of houses, see Table 13-3.
- d. By specifying sizes as noted in a, b, and c above, no foundation plans are necessary and only the exceptions need be shown on the drawings. This works out very well and saves a lot of drafting time on small residential type jobs.

### 13-6 CONCRETE SLABS

- a. Concrete slabs to be poured on the ground to serve as basement floor, porch floor, concrete walks and as underbed for flagstone and brick paving may be specified to be 4" thick not reinforced or 3" thick reinforced with No. 3 ( $\frac{3}{8}$ ") round rods placed 15" o.c. both ways or 6 x 6 6/6 welded wire fabric. To control expansion and contraction cracks which might occur, tooled joints spaced approximately 5' 0" o.c. are often specified for concrete walks.
- b. *Driveway, Carport and Garage Floor Slabs* may be specified to be 5" thick not reinforced or 4" thick reinforced with No. 3 ( $\frac{3}{8}$ ") round rods placed 15" o.c. both ways or 6 x 6 4/4 welded wire fabric. Tooled joints spaced approximately 10' 0" o.c. are often specified for driveways to control expansion and contraction cracks. It may be noted in the specifications that the carport or garage floor slab shall slope 6" from the rear toward the garage doors or carport entrance.
- c. *Self-supporting Slabs* are sometimes installed for garage roofs to make them fireproof and for porch floors to make them rotproof. The reinforcement for these slabs may be specified and, for usual conditions, may be selected from Table 13-4.
- d. *Expansion Joints* are usually called for 20 to 25 ft. o.c. along the concrete walks and driveways and where concrete walks or driveways abut and where they abut sidewalks, steps or carport or garage apron. These expansion joints are often specified to be made with  $\frac{1}{2}$ " asphalt-impregnated fiber.
- e. *Vapor Barrier* is often specified to be applied over the subgrade (or over stone or gravel fill) before concrete slabs on grade within the building lines are poured. If the subgrade cannot be made smooth by

TABLE 13-4. SAFE SUPERIMPOSED LOAD IN LB. PER SQ. FT.  
FOR ONE WAY SOLID CONCRETE SLABS SIMPLE SPAN\*  
( $f_s = 20,000$  p.s.i.;  $f_c = 800$  p.s.i.;  $n = 15$ ;  $\frac{3}{4}$ " clear fireproofing)

Total Thickness of Slab	Size (In.)	Spacing (In.)	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'
3	$\frac{3}{8}$ " $\phi$	7	240	140	86	53									
3½	$\frac{3}{8}$ " $\phi$	5½		231	147	96	63	41							
4	$\frac{3}{8}$ " $\phi$	4½			223	150	103	71	48						
4½	$\frac{1}{2}$ " $\phi$	7½			301	206	145	103	73	50	33				
5	$\frac{1}{2}$ " $\phi$	6½				280	199	144	105	76	54	36			
5½	$\frac{1}{2}$ " $\phi$	5½					264	194	144	107	79	57			
6	$\frac{1}{2}$ " $\phi$	5						248	187	142	107	80	59	41	
6½	$\frac{1}{2}$ " $\phi$	4½							237	181	139	107	81	60	43
7	$\frac{5}{8}$ " $\phi$	6½							282	217	168	131	101	76	56

\* Taken from *Simplified Design of Concrete Floor Systems* published by the Portland Cement Association.

other means (or over the surface of the stone or gravel fill), sand should first be applied to prevent protrusions that may cause rupture of the film. Vapor barrier is often specified to be 4-mil (0.004") polyethylene film. Film should be lapped not less than 6" and sealed and should be turned up at edges to top of slabs.

### 13-7 CONCRETE STEPS (Figure 13-1)

If concrete steps are supported by the ground, it may be specified that the concrete step slab is to be at least 3" thick at the narrowest point and reinforced with No. 3 ( $\frac{3}{8}$ " ) bars 12" o.c. both ways. The specification writer

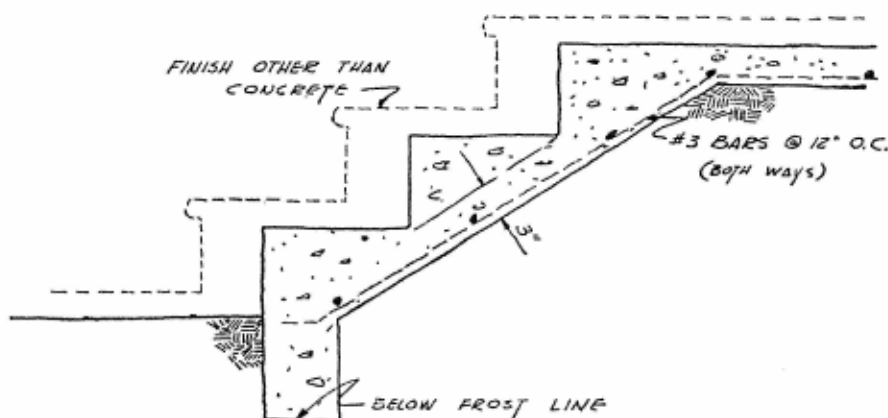


FIG. 13-1 CONCRETE STEPS

should mention that all brick and flagstone steps are to be supported by concrete unless the drawings clearly show this.

### 13-8 CONCRETE LINTELS

Although concrete lintels are not often used in frame buildings, they might be used in connection with fireproof garage walls or for masonry basement walls. Unless the drawings clearly show it, the specifications should give the location of these lintels and specify the reinforcing steel.

### 13-9 HEARTH CONSTRUCTION (Figure 13-2)

Unless brick arches are shown in hearth construction in frame buildings, a concrete slab is generally used. The specifications may mention that the hearths are to be made of 4" concrete slab reinforced by No. 3 ( $\frac{3}{8}$ " ) round

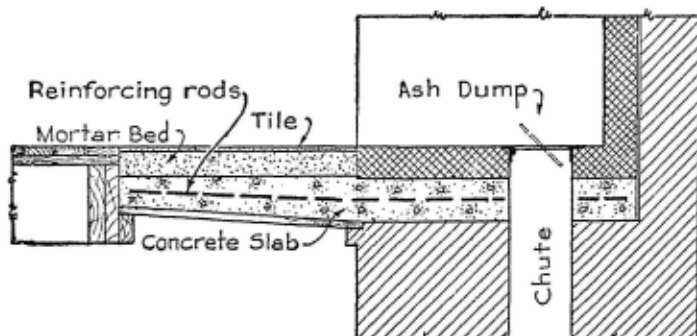


FIG. 13-2 CONCRETE SLAB FOR HEARTH

rods 12" o.c. both ways. If the hearth is to be of marble, it may be mentioned that this is called for under *Marble and Tile* section.

### 13-10 CEMENT FINISH

a. On large commercial and industrial work where there will be a lot of traffic and wear on slabs, the cement finish is usually one of the following:

1. *Integral Finish* consists of a  $\frac{1}{2}$ " to 1" concrete topping applied while the structural slab is still green.
2. *Applied Topping* consists of a concrete topping applied after the base slab has cured. This is either a thin  $\frac{3}{4}$ " to 1" topping applied to the slab after bonding material has been used or a thick topping and finish from 1  $\frac{3}{4}$ " to 3" thick applied to the slab after it has been grouted. These applied toppings should be specified also on small construction work to cover metallic or membrane waterproofing when

they are applied to slab. The  $\frac{3}{4}$ " to 1" topping may be used with the metallic type waterproofing and the  $1\frac{3}{4}$ " to 3" topping with the membrane type.

- b. For residential work and for slabs on other jobs where there is little wear, the specification writer may specify that the structural slab is to receive a monolithic finish; the coarse aggregate shall be beaten down with a trowel and the remaining surface trowelled. A dry mix of one part of cement to  $1\frac{1}{2}$  parts of fine aggregate may be added where necessary to take up the excess moisture. The specification writer should mention that exterior slabs are to have a wood trowel finish and that interior slabs are to have a smooth steel trowel finish.
- c. Where formed concrete is exposed in the completed work, the specification writer may wish to stipulate that these surfaces are to be pointed with cement mortar and then wet-rubbed with abrasive stone, the paste worked up on the surface to be scraped off during the rubbing.

### 13-11 CURING

To obtain the greatest strength of concrete and to keep it from cracking, it must be cured properly. The specification writer should mention that all concrete surfaces shall be kept continuously wet for a period of not less than 7 days after pouring. This may be done by sprinkling the slabs and the forms daily. It is usually not necessary on residential work to specify a sand, shaving, kraft paper or polyethylene film covering or a liquid membrane-forming curing compound meeting the requirements of ASTM Spec. C309 for the concrete slabs, provided they are sprinkled daily.



## CHAPTER 14

### Masonry

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#### 14-1 BRICK

- a. Clay brick are known to have been used approximately 6,800 years ago. They are still being used today, and it is safe to assume that they will continue to be used in building, in spite of the development of other materials, because brick are economical and easy to use.
- b. Brick generally used in residential work are made from clay or shale, or a combination of both. Shale is a hardened or rock-like clay that requires grinding for use in brick making.
- c. A brick plant is usually located near some strata of clay or shale used in making the brick; thus, clay or shale brick are inexpensive for buildings located near brick plants, but the freight rate adds to the cost of the brick for buildings some distance from the source.
- d. Brick are also made of fire clay, lime and cement. Brick made from clay and shale come out of the kilns red or brown, whereas brick made of fire clay burn to buff, gray or white color. Concrete brick and sand-lime brick are often specified for economy, since they can be made in any locality.
- e. The most common method of manufacture of clay brick is by extruding through a die a column of clay which is wire cut into the size brick desired. Sometimes these brick are repressed. Brick are also made by moulding and dry pressing.
- f. *Common Brick*, as the name implies, are brick that meet a certain requirement as to strength and absorption without regard to the appearance. In some localities the common brick are quite handsome and are used for face work, but generally, these brick are mechanical looking and the colors too uninteresting to warrant their use in facing work unless the masonry is to be painted.
- 1. *Use:* For residential work, common brick are often specified for foundation walls below grade, for all exposed masonry work in the base-

ment and unexcavated areas of the building and as backup for all exposed face brick where solid masonry walls are indicated.

2. *Type:* Common brick are most easily specified by reference to the ASTM Spec. C62. Since the ASTM Spec. designates three grades, it is necessary to select one or two of the following, otherwise the Contractor would be within his rights to furnish any one of the grades.

*Grade SW:* Brick intended for use where a high degree of resistance to frost action is desired and the exposure is such that the brick may be frozen when permeated with water.

*Grade MW:* Brick intended for use where exposed to temperatures below freezing but unlikely to be permeated with water or where a moderate and somewhat nonuniform degree of resistance to frost action is permissible.

*Grade NW:* Brick intended for use as backup or interior masonry or, if exposed, for use where no frost action occurs or, if frost action occurs, where the average annual precipitation is less than 20".

The compressive strength for *Grade SW* is greatest and the compressive strength for *Grade NW* the least.

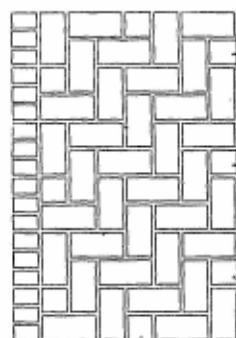
3. *Size* (Table 14-1): The size of the brick to be used should be mentioned in the specifications. These sizes vary in different sections of the country and a check with some local plant should be made before selecting the size. Standard brick are usually  $2\frac{1}{4}" \times 3\frac{3}{4}" \times 8"$ .
- g. *Face Brick:* Unless a selection of face brick has been made prior to the preparation of the specifications the best method to use in specifying face

TABLE 14-1. BRICK SIZES

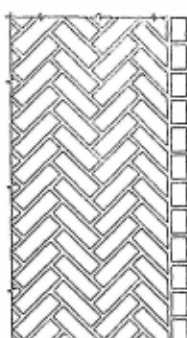
Type of Brick	Size	Remarks
Standard	$2\frac{1}{4}" \times 3\frac{3}{4}" \times 8"$	3 Courses + 3 joints = 8"
Oversized	$2\frac{5}{8}" \times 3\frac{3}{4}" \times 8"$	5 Courses + 5 joints = 16"
Modular for $\frac{1}{2}"$ Joint	$2\frac{1}{8}" \times 3\frac{1}{2}" \times 7\frac{1}{2}"$	3 Courses + 3 joints = 8"
Modular for $\frac{3}{8}"$ Joint	$2\frac{1}{8}" \times 3\frac{5}{8}" \times 7\frac{3}{4}"$	3 Courses + 3 joints = 8"
Oversized Modular	$2\frac{7}{8}" \times 3\frac{1}{2}" \times 7\frac{1}{2}"$	5 Courses + 5 joints = 16"
Roman for $\frac{1}{8}"$ Joint	$1\frac{3}{4}" \times 3\frac{1}{2}" \times 11\frac{1}{2}"$	4 Courses + 4 joints = 8"
Roman for $\frac{3}{8}"$ Joint	$1\frac{3}{4}" \times 3\frac{5}{8}" \times 11\frac{5}{8}"$	4 Courses + 4 joints = 8"
Norman for $\frac{1}{2}"$ Joint	$2\frac{1}{8}" \times 3\frac{1}{2}" \times 11\frac{1}{2}"$	3 Courses + 3 joints = 8"
Norman for $\frac{3}{8}"$ Joint	$2\frac{1}{8}" \times 3\frac{5}{8}" \times 11\frac{5}{8}"$	3 Courses + 3 joints = 8"
Norwegian for $\frac{3}{8}"$ Joint	$2\frac{13}{16}" \times 3\frac{5}{8}" \times 11\frac{5}{8}"$	5 Courses + 5 joints = 16"
SCR	$2\frac{1}{4}" \times 5\frac{1}{2}" \times 11\frac{1}{2}"$	3 Courses + 3 joints = 8"
Jumbo	$3\frac{1}{2}" \times 7\frac{1}{2}" \times 11\frac{1}{2}"$	2 Courses + 2 joints = 8"
Firebrick	$2\frac{1}{2}" \times 4\frac{1}{2}" \times 9"$	Also made in standard size
Soap Firebrick	$2\frac{1}{2}" \times 2\frac{1}{2}" \times 9"$	

brick is to establish an allowance per thousand for their purchase. The cost per thousand of the face brick may vary from \$45.00 per M to \$125.00 per M, and the specification writer should check with the dealers before establishing the amount to have it approximate the final cost. It is most important to stipulate in this paragraph that the Contractor shall include in his bid all overhead and profit and the cost for unloading, hauling and stacking the brick at the job. The unit cost should be established f.o.b. railroad siding in the city where the job is located.

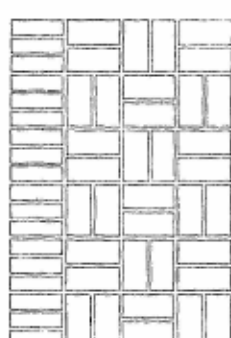
1. *Use:* Face brick are usually specified to be used for all brick work exposed to view on the exterior of the building. If it is desired to have face brick on the back of parapets, this also should be mentioned.
2. *Type:* There is no need to mention the type of face brick unless some unusual type is to be used that would affect the cost of laying the brick as this brick will be purchased under an allowance. Different types of face brick are obtained by use of various materials, by burning and by the method of manufacture. Extruded wire cut brick are often re-pressed. Many face brick are hand-moulded; when the moulds are flushed with water the resulting brick is termed *water struck*; when moulds are flushed with sand the resulting brick is called *sand struck*.
3. *Size* (Table 14-1): The size of the brick should be mentioned as this will influence the quantity take-off and the cost of laying. The same as common brick, face brick sizes vary in different localities but standard brick are usually  $2\frac{1}{4}" \times 3\frac{3}{4}" \times 8"$ .
4. *Shipment:* To avoid spalling and damage to the face brick it should be specified that they are to be shipped in straw and handled with tongs.
5. *Special Face Brick:* If the exterior corners of the structure do not make a 90 degree angle, to assure a neat-looking job, it is necessary for the brick to be ground or cast specially to form the corners. If such a condition exists in the drawings, this should be specified and mention made that the cost of the specially cast brick or the grinding is not part of the allowance but is to be included in the base bid.
6. *Second-Hand Brick:* Some Architects specify second-hand brick for face brick work where a highly textured, informal type of surface is desired. The old mortar stains lighten the appearance of the work, and the broken pieces add to the texture where this effect is desired. Although the second-hand brick is often less expensive than new brick, the masons make up a great deal of the cost as it is more difficult to handle and lay old brick.
- h. *Paving Brick* (Figure 14-1): Brick are often used for paving in residential work:



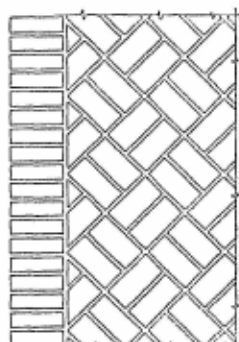
**Brick Laid Flat  
Rowlock Header Border**



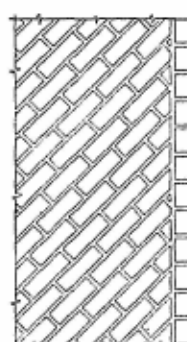
**Brick On Edge  
Header Border**



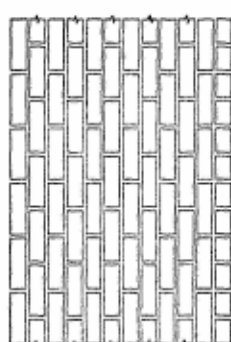
**Brick Laid Flat  
Soldier Border**



**Brick Laid Flat  
Soldier Border**



**Brick on Edge  
Header Border**



**Brick on Edge  
Header Border**

**FIG. 14-1 PAVING BRICK (Courtesy Southern Brick & Tile Assoc.)**

1. *Use:* Brick are used for paving entrance walks, steps and driveways and are usually indicated on the Plot Plan.
2. *Type:* When the pavement is to be laid on edge, standard-sized brick may be used. If the pavement is to be laid flat, the specification writer should mention that the brick are not to be cored and the flat exposed surface is to be the finished surface of the brick and not the wire cut surface. Brick for such use should be hard-burned and low in absorption.
3. *Size:* Standard-sized brick may be used for paving or special paving brick in a cluster of 4 as made by some of the brick manufacturers. When split apart the clusters form 4 individual slabs measuring  $1\frac{1}{8}$ " thick,  $3\frac{3}{4}$ " wide, and 8" or 12" long.
  - i. *Concrete Brick* are manufactured from a mixture of portland cement

and suitable aggregates such as sand, gravel, crushed stone, bituminous or anthracite cinders, burned clay or shale, or blast furnace slag.

1. *Use:* Concrete brick may be specified as a substitute at the Contractor's option for common clay brick or may be specified in place of the common clay brick. Under either circumstance the concrete brick should not be used in chimney construction since the concrete brick have greater expansion and contraction than the clay brick. Occasionally concrete brick are specified for the face work also.
2. *Type:* Concrete brick are most easily specified by mentioning the product from a particular local plant or by reference to the ASTM Spec. C55 and one of the following grades selected:

*Grade A:* Brick intended for use where exposed to temperature below freezing in the presence of moisture.

*Grade B:* Brick intended for use as backup or interior masonry.

The compressive strength of *Grade A* is greater than *Grade B*.

3. *Size* is established by the ASTM Spec. by a note stating "Standard dimensions of units are the manufacturers' designated dimensions." This standard dimension is usually  $2\frac{1}{4}" \times 3\frac{5}{8}" \times 7\frac{5}{8}"$ .
- j. *Sand-Lime Brick* are brick made from sand and lime and intended for use in brick masonry.
1. *Use:* Same as noted for concrete brick above. Sand-lime brick are used in the colder climates such as the northeastern quarter of the United States.
  2. *Type:* Sand-lime brick are most easily specified by mentioning the product from a particular local plant or by reference to ASTM Spec. C73 and one or more of the following grades selected:
- Grade SW:* Brick intended for use where exposed to temperature below freezing in the presence of moisture.
- Grade MW:* Brick intended for use where exposed to temperature below freezing but unlikely to be saturated with water.
- Grade NW:* Brick intended for use as back-up or interior masonry or, if exposed, for use where no frost action occurs or, if frost action occurs, where the annual precipitation is less than 15 in.

The compressive strength of *Grade SW* is greatest and the compressive strength of *Grade NW* the least.

3. *Size* is not established by ASTM Spec.; therefore the size required should be specified.
- k. *Fire Brick*: Fire brick are made from fire clay and are made to resist different heat intensities.
  1. *Use*: Fire brick for residential work are usually specified for the lining of fireplaces and for the paving of the inner hearth.
  2. *Type*: Fire brick may be easily specified by reference to the ASTM Spec. C27 and by stipulating *Intermediate Heat Duty Fire Clay Brick*. In addition to this grade there are the *Low Heat Duty Fire Clay Brick* usually specified for back-up work in the exterior walls of boilers, etc., but where the brick does not come in direct contact with the heat; and the two following grades specified for boiler installations: *High Heat Duty Fire Clay Brick* and *Super Heat Duty Fire Clay Brick*.
3. *Size* (Table 14-1): The size of fire brick should be specified.
- l. *Samples*: The specifications should require samples of each type of brick or other masonry units to be submitted to the Architect for approval.

#### 14-2 FIRE CLAY

Fire clay is a special, ground, inert clay used as a mortar for laying up fire clay brick. It may be specified by reference to ASTM Spec. C105 and by designating commercial grade *C* (the other grade is fine grade *F*) and by designating *Intermediate Heat Duty Class* (the other classes are: *Low Heat Duty*, *High Heat Duty* and *Super Heat Duty*).

#### 14-3 FLUE LININGS

- a. Flue linings are round, square or rectangular pipe sections used for lining flues where there is moderate heat duty.
- b. *Use*: For residential work flue linings are specified for the flues serving fireplaces, gas, oil-fired or coal-fired furnaces, boilers and hot water heaters.
- c. *Type*: Flue linings are generally specified to be made of inert clay and to be hard burned, free from cracks and meeting the requirements of ASTM Spec. C315.
- d. *Size*: Unless the drawings clearly show the size of flue linings, the specifications should establish the size for each condition. Flues for furnaces, hot water heaters and boilers should be of sizes recommended by the manufacturer of the equipment. Flue linings for fireplaces should be computed and should not be less than the following:

<i>Fireplace Openings Up to</i>	<i>Minimum Flue Lining Size</i>
26" x 24"	8½" x 8½"
32" x 29"	8½" x 13"
48" x 32"	13" x 13"
60" x 37"	13" x 18"

#### 14-4 CONCRETE BLOCK (Figure 14-2)

- a. Concrete block are hollow or solid concrete masonry wall units made from portland cement and suitable aggregates such as sand, gravel, crushed stone, bituminous or anthracite cinders, burned clay or shale, or blast furnace slag. Two lightweight aggregates often used in the manufacture of concrete block are as follows:
  1. *Aggregate*, consisting of crushed clinkers resulting from the burning of crushed shale or clay. The weight of the dry rodded fine aggregate shall be not less than 50 lbs. per cu. ft. nor more than 70.5 lbs. per cu. ft.
  2. *Aggregate*, consisting of steam-processed slag, in the form of porous particles predominately light buff in color, somewhat friable in character. The weight of the dry rodded fine aggregate shall be not less than 54 lbs. per cu. ft. and not more than 65 lbs. per cu. ft.
- b. *Use*: Concrete block are often specified for foundation walls and veneers and for the masonry partitions in basement areas. In low-rent housing and school work the block are often used for all partitions and backup work and are left exposed and painted. Because of the large units, the cost of concrete block is usually less than for similar walls and partitions of clay or concrete brick. Because of its porous nature, special attention has to be given to waterproofing walls below grade; and because of its great expansion and contraction, it is necessary to reinforce the exterior walls constructed of this material.
- c. *Type*: Concrete block are most easily specified by reference (to ASTM Spec. C129 for hollow nonload-bearing block) to ASTM Spec. C90 for hollow load-bearing and to ASTM Spec. C145 for solid load-bearing block. If it is desired to have the units of lightweight aggregates, the sand gravel and crushed stone should be omitted; and if it is desired that the block have a light-color finish, the use of bituminous or anthracite cinders should not be permitted by the specifications.
- d. *Moisture Content*: Because of the tendency of concrete block to expand and contract due to moisture content, the following requirement is often included in the specification:

"Moisture content of block shall be not greater than 30% of total absorption. Block shall be cured under shelter for at least 28 days

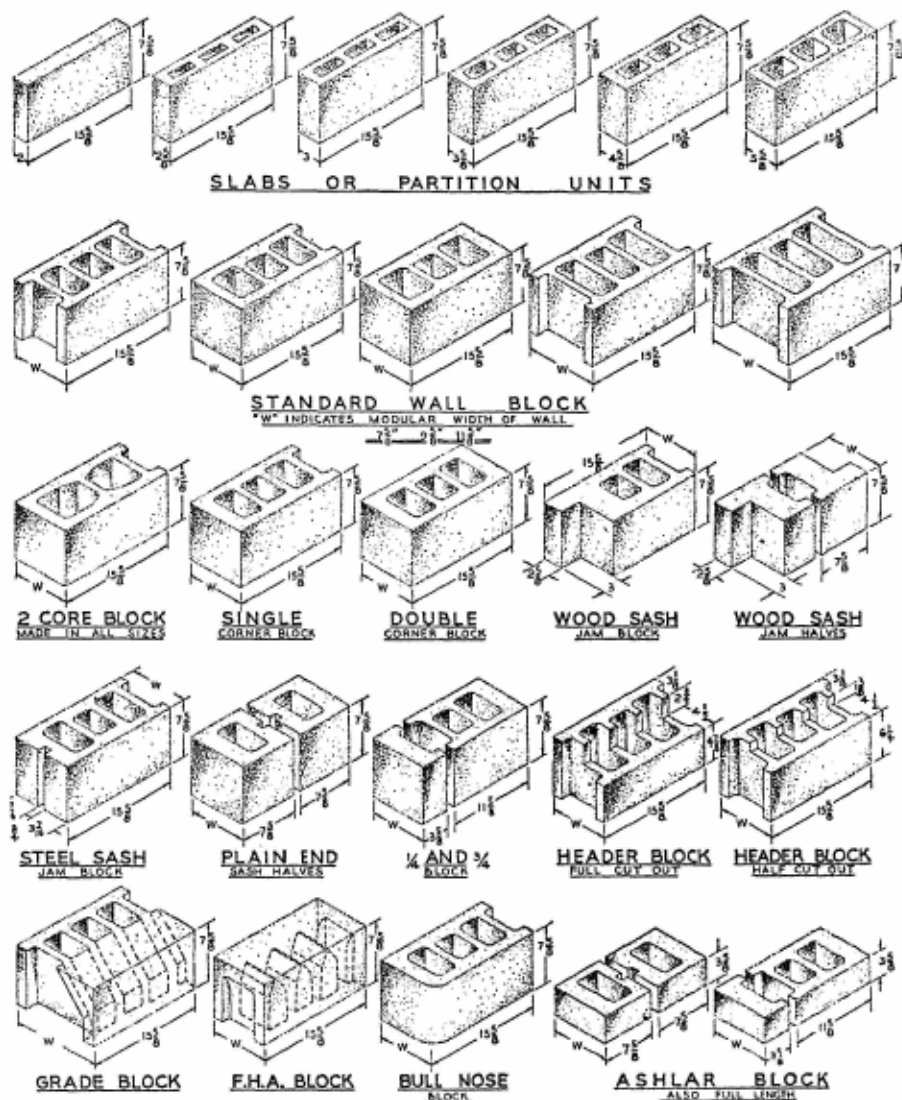


FIG. 14-2 CONCRETE BLOCK (Courtesy Besser Manufacturing Co., Alpena, Mich.)

NOTE: Only basic shapes are shown here. Most plants make many other shapes.

or shall be made by the autoclave process, and shall be stored under shelter at job site. Units exposed to the rain or units with chipped, cracked or spalled faces will not be acceptable."

- e. *Size:* Since the ASTM Specifications do not designate size, the specifications should state that the units will be  $7\frac{5}{8}" \times 15\frac{5}{8}"$  and of thickness



indicated on the drawings, and that special units shall be furnished for corners, headers and jambs. The size noted above is based on the use of a  $\frac{3}{8}$ " mortar joint and is the most popular size throughout the country. Other sizes manufactured are  $7\frac{3}{4}$ " x  $15\frac{3}{4}$ " based on the use of  $\frac{1}{4}$ " mortar joint, and  $7\frac{1}{2}$ " x  $15\frac{1}{2}$ " based on use of  $\frac{1}{2}$ " mortar joint.

#### 14-5 STONE

- a. On more formal buildings than are being considered in this text, cut stone such as marble, granite and limestone are often used. These stones are quarried and finished mechanically and should be specified in a separate section. Natural and split stones are often used for residential work.
- b. *Use:* Stone is usually specified for garden walls and retaining walls, although sometimes it is used for facing, for chimneys and foundation walls.
- c. *Type:* For residential work it is economical to specify local stone giving the source of supply. Stone is divided into two general classifications:
  1. *Natural Stone* is stone found in its natural setting which is removed and placed into walls without splitting the stones. These stones are often weathered into interesting colors, and stone walls made from these natural stones have an antique instead of a new looking face and blend with their natural surroundings. These stones may be specified by giving their source of location and by referring to them as *Natural Fieldstone*, *Natural Creek Stone*, or *Natural Boulders*.
  2. *Split Stone* is stone requiring a certain amount of splitting to remove it from its original location. These are best specified by referring to the location. Some of these stones require splitting on all sides, whereas others are *Ledge Rock* and require less splitting. The *Split Stone* face is usually exposed in the wall, and the wall does not have the weathered look of those made with natural stone.
- d. *Size:* Certain size limits for stone could be incorporated in the specifications after the details have been studied, or the specification writer may stipulate that stone shall be of sizes to give the general effect indicated by the detail drawings.

#### 14-6 FLAGSTONE

- a. Flagstone is a quartzite which is formed in strata and splits easily into thin sections of stone. Flagstone is very hard and has been used for many years as a paving material and in more recent years as a building stone.
- b. *Use:* Terraces, walks and steps in residential work are often paved with flagstone, and sometimes the stone is used for capping brick or stone

walls. Some housewives object to flagstone for porches where furniture is to be set because of its irregularity of surface.

- c. *Type*: Probably the best way to specify flagstone is to call for flagstone from certain quarries by name. It is necessary to check locally and find out which quarries produce the type of flagstone required.
- d. *Size*: Flagstone for paving should be limited in thickness as well as surface area. The thickness can be limited to a range of  $\frac{3}{4}$ " to  $1\frac{1}{4}$ ", and in area to a range of from 1 sq. ft. to 4 sq. ft. Flagstone used for rubble veneer is usually specified to be 4" wide and of random thickness from  $1\frac{1}{2}$ " to 6" and of random lengths.

#### 14-7 WALL TIES

- a. Wall ties are strips of metal used in masonry work where the masonry work is not otherwise bonded to the backing.
- b. *Use*: Wall ties are specified for bonding all 4" veneer to the backing and are specified to be spaced not more than 16" vertically and 32" horizontally. When stacked brick work is used, wall ties should be specified to be placed across each vertical joint every 8".
- c. *Type*: Wall ties may be specified to be crimped 24 gauge galvanized steel. These are also made of 22, 20, 18 and 16 gauge galvanized steel or of copper, zinc or brass.
- d. Size of wall ties is usually specified to be 7" x  $\frac{3}{4}$ ".

#### 14-8 MORTAR MATERIALS

- a. *Portland Cement* may be specified by brand names or merely by reference to ASTM Specification C150 and *Type I* designated. See Subparagraph a of Paragraph 13-2.
- b. *Masonry Cement* may be specified by brand names or simply by reference to ASTM Spec. C91, Type II.
- c. *Slag Cement* may be specified by reference to brand names or merely by reference to ASTM Spec. C358.
- d. *Lime Putty* is generally made by mixing hydrated lime (meeting requirements of ASTM Spec. C207) with water to form a putty; it is stored for at least 24 hours before use and may be so specified. An older specification for lime putty, and one still in use to some extent as an optional method, is by slaking quick lime meeting requirements of ASTM Spec. C5 with water to make a cream. This cream should be passed through a No. 10 sieve and stored to prevent evaporation for at least 7 days before use.
- e. *Fine Aggregate for Masonry Mortars* may be specified by reference to sand from a particular source where the purity and general grading of the fine aggregate is known, or it might be specified by reference to

ASTM Spec. C144 which permits the fine aggregate to be composed of fine to coarse particles to be graded as follows:

Sieve Size	PERCENTAGE PASSING	
	Natural Sand	Manufactured Sand
No. 4	100	100
No. 8	95 to 100	95 to 100
No. 16	60 to 100	60 to 100
No. 30	35 to 70	35 to 70
No. 50	15 to 35	20 to 40
No. 100	2 to 15	10 to 25
No. 200	—	0 to 10

- f. *Water* should, of course, be clean and free from a deleterious amount of impurities, but it is probably superfluous to mention it in a short specification.

#### 14-9 MORTAR

- a. Mortar is the plastic mass obtained by mixing water with lime and sand, cement and sand, or cement, lime and sand. The function of mortar is to:
1. Bind the masonry units together,
  2. Carry and distribute its share of the load,
  3. Adhere to the masonry units to form a solid mass,
  4. Become a part of the texture and pattern of exposed mortar.
- b. In small buildings the ability of mortar to carry and distribute the load is not as important a factor as its power to adhere to the masonry units and thus help to prevent the entrance of water. Variations in composition give mortars of different properties, some better suited than others for a particular purpose.
- c. *Cement Mortar* is composed of the following by volume:
- |                        |              |
|------------------------|--------------|
| 1 part portland cement | 3 parts sand |
| 15% lime putty         |              |

This mortar has high strength; it is not as plastic and therefore harder to work than other mortars; it sets up faster and therefore does not adhere as well as other mortars. This mortar is recommended for use in masonry for steps, pavement, manholes, pipe tunnels and foundations for tanks and machinery.

- d. *Cement-Lime Mortar* is composed of the following by volume:
- |                        |              |
|------------------------|--------------|
| 1 part portland cement | 6 parts sand |
| 1 part lime putty      |              |

This mortar works smoothly, produces masonry of high strength and is recommended for general-purpose work in the winter, as it tends to set faster than slag cement mortar or masonry cement mortar.

- e. *Lime-Cement Mortar* is composed of the following by volume:

1 part portland cement	9 parts sand
2 parts lime putty	

This mortar is easily workable and tends to prevent the opening of cracks while having sufficient compressive strength for ordinary requirements. This mortar is recommended for watertight masonry for all types of work.

- f. *Lime Mortar* is composed of the following by volume:

1 part lime putty	3 parts sand
-------------------	--------------

This mortar is the most easily worked mortar obtainable, adheres well but lacks strength; it sets up slowly and can be prepared in large quantities in advance. Lime is the oldest plasticizer and binder, and lime mortar was used extensively in early masonry work. This mortar is recommended for interior nonload-bearing partitions and temporary masonry work since a wall made of lime mortar is easily wrecked.

- g. *Masonry Cement Mortar* is composed of the following by volume:

1 part masonry cement	3 parts sand
-----------------------	--------------

Masonry cement mortars may be made up of various cements, provided they meet certain standards. Most masonry cement mortars work smoothly, are light in color and set more slowly than cement-lime mortar. Masonry cement mortar is recommended for all-purpose work in all seasons except winter. It is best for the Architect to be familiar with the particular brand when specifying masonry cement mortar.

- h. *Slag Cement Mortar* is composed of the following by volume:

1 part slag cement	6 parts sand
1 part lime putty	

Slag cement is made from slag, a by-product of the steel industry. In certain sections of the country it is cheaper than portland cement. This mortar works smoothly, is of a light color and sets up more slowly than cement-lime mortar. It is recommended for general-purpose work in all seasons except winter.

- i. *Alternate Method of Specifying Mortars:* Instead of giving formulas as listed above, some specification writers specify that mortars meet the requirements of ASTM Spec. C270 entitled "Mortars for Unit Ma-

sonry," and designate the type or types required, selected from the following:

1. *Type M*: Having an average compressive strength of 2,500 psi corresponding closely with *Cement Mortar* described above.
2. *Type S*: Having an average compressive strength of 1,800 psi and corresponding closely with *Cement-Lime Mortar* described above.
3. *Type N*: Having an average compressive strength of 750 psi and corresponding closely with *Masonry Cement Mortar* described above.
4. *Type O*: Having an average compressive strength of 350 psi and corresponding closely with *Lime-Cement Mortar* described above.
5. *Type K*: Having an average compressive strength of 75 psi and corresponding closely with *Lime Mortar* mentioned above.

#### 14-10 LAYING BRICK

- a. In specifying the laying of brick work it is most important to call for a full bed of mortar with each course well hammered down, and the vertical and all other joints completely filled with mortar. It should be specified that the brick is to be laid plumb and true, and sometimes it is specified that a story rod shall be used in laying out the work. Clay or shale brick should be moistened slightly before they are laid. The bonding and type of joints should also be specified.
- b. *Bonding*: Figure 14-3 shows a few of the various types of bonds that may be specified. The running bond is specified often for brick veneer work on frame buildings. The common bond with a header course every sixth or seventh course is the bond generally specified for walls where the architectural effect of the bond is not an important factor. All other types of bonds are more expensive and are specified, of course, for architectural effect.
- c. *Joints* (Figure 14-4): Standard and modular brick are usually specified to be laid 3 courses and 3 joints to a module of 8", whereas oversized standard and oversized modular brick are specified to be laid 5 courses and 5 joints to a module of 16"; this results in joints approximately  $\frac{3}{8}$ " or  $\frac{1}{2}$ " depending upon the exact size of brick selected (See Table 14-1). Masonry joints should be raked back  $\frac{3}{4}$ " where cap flashing occurs. The treatment of exposed joints should be specified as selected from the following list:
  1. *Struck Joint*, formed as a plain cut joint and finished with the edge of trowel, is the cheapest type of exterior joint and is often specified

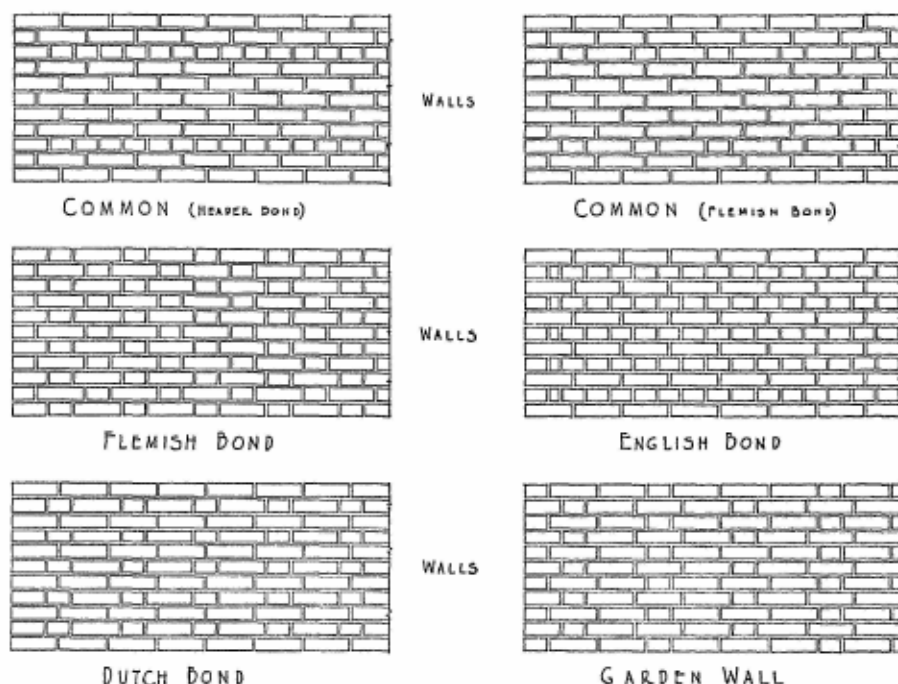


FIG. 14-3 BRICK BONDS

for exterior exposed surfaces and exposed surfaces of basement walls. The brick at bottom on this joint forms a slight ledge.

2. *Weathered Joint* is similar to a struck joint except the slight brick ledge is at the top of the joint and casts a small shadow on the joint. This joint is weather resistive and is recommended for exposed exterior joints.
3. *Raked Joint*, formed as plain cut joint and then raked to a depth desired, may be given a smooth or rough finish. This joint is specified for architectural effect and for masonry walls to receive plaster. This joint should not be specified for textured brick.
4. *Stripped Joint* is formed with a strip of wood, the thickness of the joint put at the face of the brick; the mortar is then applied behind this strip and the next course laid. When the mortar has set sufficiently the strip is removed, leaving a clean recessed joint since wood strip keeps mortar away from joint reveal. This type of joint is specified for architectural effect.
5. *Flush Joint (or Plain Cut Joint)*, formed by simply cutting off excess mortar with a trowel, is generally specified for surfaces which will

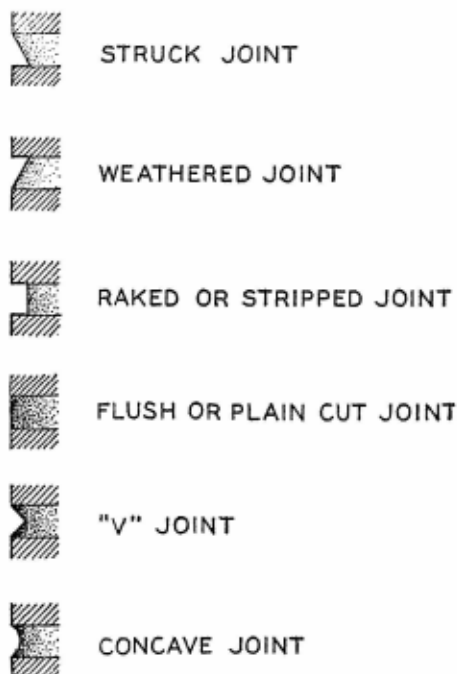


FIG. 14-4 MORTAR JOINTS

be concealed, exposed surfaces of basement walls, surfaces to be dampproofed and surfaces where a rough texture is desired.

6. "*V*" Joint is formed with a "V" shaped tool. This is a watertight and satisfactory joint, having a very dense face.
7. *Concave Joint* is formed with a special tool of a bent iron rod. It is weather resistive and inexpensive and is perhaps the most satisfactory joint to specify.

#### 14-11 CHIMNEYS (Figure 14-5)

Chimneys should be specified to be built of clay or shale brick, even though concrete block or cement brick has been used elsewhere. Chimneys should be lined with flue linings, and the mason should take care to keep mortar off smoke shelf. Space between flue linings and chimneys should be filled solid with mortar. Flues should extend slightly above chimneys and cement wash surface be provided.

#### 14-12 LAYING CONCRETE BLOCK

It should be specified in laying concrete block that there should be a full mortar coverage on vertical and horizontal face shells. The block should

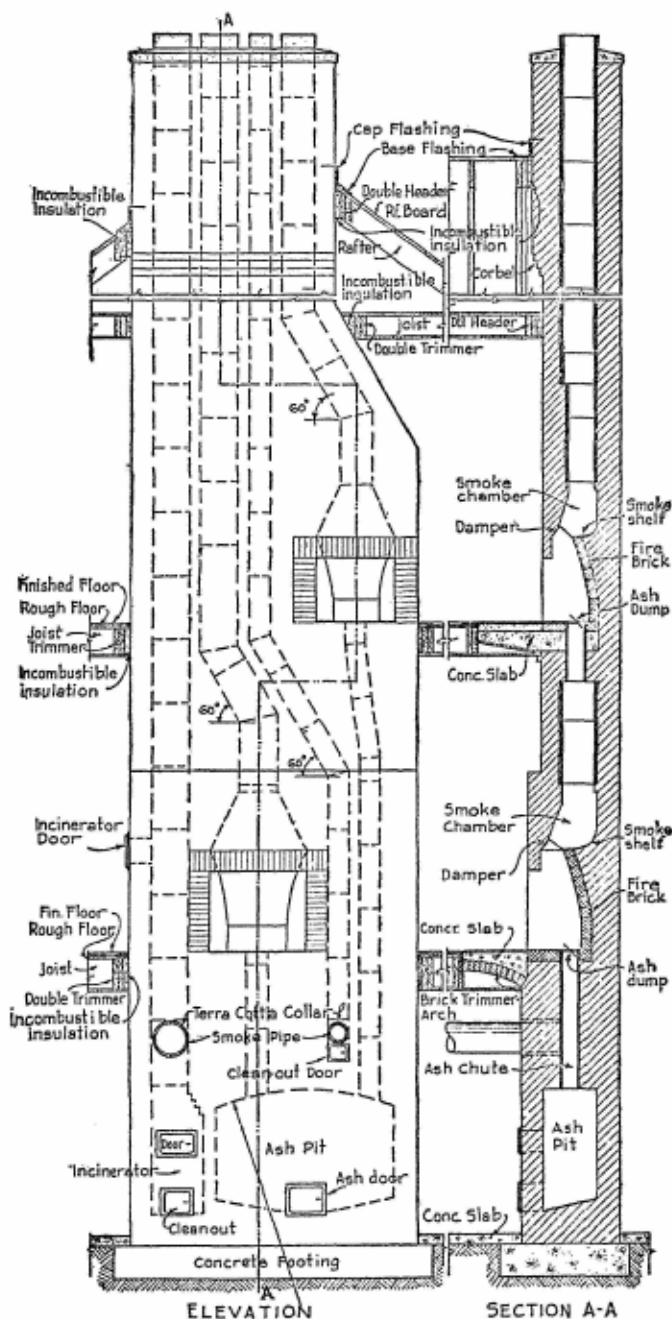


FIG. 14-5 CHIMNEY INCORPORATING BASEMENT FLUES, TWO FIREPLACES, INCINERATOR AND ASHPIT



be well hammered down and the vertical joints shoved tight. The thickness of the joint, usually  $\frac{3}{8}$ ", and the type of joint should be specified. No cells should be exposed in the completed work. Since the expansion and contraction in concrete block are greater than in brick work, reinforcement should be specified if the concrete block walls are exterior walls above grade exposed to changes in temperature. It is usually specified that galvanized steel trussed design reinforcement made of No. 9 (0.1483") gauge rods be installed in every other horizontal joint and that this reinforcement be lapped at least 6" to ensure continuity. Often a continuous concrete beam is specified at the top of the concrete block walls around the perimeter of the building. This helps to hold the concrete block walls together. This beam is often made of special "U" shaped block with reinforcing rods put in bottom and then filled with concrete. Lintels are often made the same way.

#### 14-13 LAYING FIRE BRICK

Water should be added to the fire clay until it makes a thick cream. The fire brick should be dipped into this mortar and shoved into place to make a thin joint not exceeding  $\frac{1}{8}$ " in thickness. The specification writer should mention whether the brick is to be laid flat or on edge, as this will make a difference in the number of brick required.

#### 14-14 LAYING STONE WORK

- a. Stone is specified to be laid either dry masonry (i.e., without the use of mortar) or laid with mortar. The Contractor is usually required to lay the stone flat, thus emphasizing the horizontal lines in the wall. It should be noted that the stone should be laid in full beds of mortar and the mortar raked out of the finished stone as far back as possible without destroying the proper bond. Thus the stone will give a dry masonry effect even though laid in mortar.
- b. The specification writer should not forget to include *weep holes* in the bottom of retaining walls to reduce the water pressure back of the walls. These "holes" are usually specified to be of terra cotta or copper pipe and spaced from 3' 0" to 4' 0" o.c. in the wall.

#### 14-15 LAYING FLAGSTONE RUBBLE

Flagstone rubble may be specified to be laid in random fashion of random thicknesses and random lengths with not more than three vertical joints occurring over each other. The grain of the stone should be specified to be horizontal with the edge grain showing. Joints should be specified to be approximately  $\frac{1}{2}$ " thick and raked.

#### 14-16 FLAGSTONE PAVING

- a. In specifying flagstone it should be noted specifically which type of paving will be required:
  - 1. Flagstone cut in squares and rectangles.
  - 2. Flagstone with all edges snapped to straight lines.
  - 3. Flagstone without the edges being snapped to straight lines and laid in random fashion.
- b. Type 1 is, of course, the most expensive but gives a more formal appearance to the flagstone paving. The bed for the flagstone paving may be of sand or of concrete, as described subsequently as under *Brick Paving*. Joints in flagstone paving may be specified to be approximately  $\frac{1}{2}$ " thick for Type 1,  $\frac{3}{4}$ " for Type 2 and not over 1" for Type 3.

#### 14-17 BRICK PAVING

- a. There are three general methods of laying brick paving:
  - 1. Laying brick on sand bed with vertical joints sanded.
  - 2. Laying brick on sand bed with vertical joints filled with dry mortar and moistened.
  - 3. Laying brick on concrete bed with joints filled with mortar grout.
- b. When the vertical joints are filled with mortar grout (3 above), it should be specified that the surface of the brick be painted with a paraffin oil to prevent stain.
- c. If dry mortar is used for the vertical joints, the paving should be sprayed with water, after the dry mortar has been swept into the joints, to set the mortar.
- d. The specifications should mention the pattern which will probably be one of the following: basket weave pattern laid diagonally, basket weave pattern laid straight, herringbone pattern laid diagonally, and herringbone pattern laid straight; see Figure 14-1. The specification writer should stipulate whether the brick are to be laid flat or on edge. It takes approximately 4.5 brick per sq. ft. for brick laid flat and 6.2 brick for brick laid on edge per sq. ft. of paving.

#### 14-18 MISCELLANEOUS METAL WORK

It might be mentioned that the masonry Contractor is to install miscellaneous metal items such as dampers, clean-out doors, dumps and steel lintels to be furnished under the *Miscellaneous Metal* section of the specifications.

#### 14-19 PLASTIC FLASHING

If the drawings indicate concealed flashing at the sills and lintels or concealed through-wall flashing, this is often specified to be of 20-mil (0.02")

polyvinyl chloride film. Joints should be lapped at least 6" and cemented with special cold-setting cement as recommended by the manufacturer's printed directions to make a watertight joint.

#### 14-20 CLEANING

Unless the exposed brick work is to be painted, it should be specified that the brick is to be cleaned with a solution of not stronger than 10% muriatic acid and 90% water. The walls should not be washed until mortar is fully set. Walls should be thoroughly sprayed with water before application of the acid solution. After these surfaces are cleaned with the acid solution, it should be specified that they are to be washed thoroughly with clean water.

## CHAPTER 15

# Waterproofing

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### 15-1 GENERAL (Figure 15-1)

- a. *Waterproofing* is a construction process whereby an impermeable barrier is created to withstand water pressure, and *Dampproofing* is a construction process whereby an impermeable barrier is created to withstand water without pressure (moisture). Although many methods have been evolved for waterproofing, this text includes only two types: *Metallic Method* and *Membrane Method*. These two types of waterproofing have been used for many years and their value is known, whereas most of the other types of waterproofing are still in the experimental stage.
- b. *Dampproofing* consists of surface coatings and the pointing and caulking of joints and flashings within masonry walls. Dampproofing is very important in masonry construction. Since this text deals primarily with frame structures, methods of dampproofing are not included.

### 15-2 AREAS TO BE WATERPROOFED

One paragraph of the specifications should stipulate the areas to be waterproofed by metallic waterproofing and those to be waterproofed by membrane waterproofing. These areas are usually the basement walls around the excavated portions of the building and all basement floor slabs. Metallic waterproofing is usually applied to the interior surfaces of the walls, whereas membrane type waterproofing is always applied to the exterior surfaces of the walls. The metallic type of waterproofing on the walls may be specified to extend from the top of the slab up to the bottom of the floor joists, and the membrane waterproofing is often specified to extend from the grade line down to and over the top of footings. In certain localities where the water table is not high, only the walls are waterproofed and not the basement floor slabs.

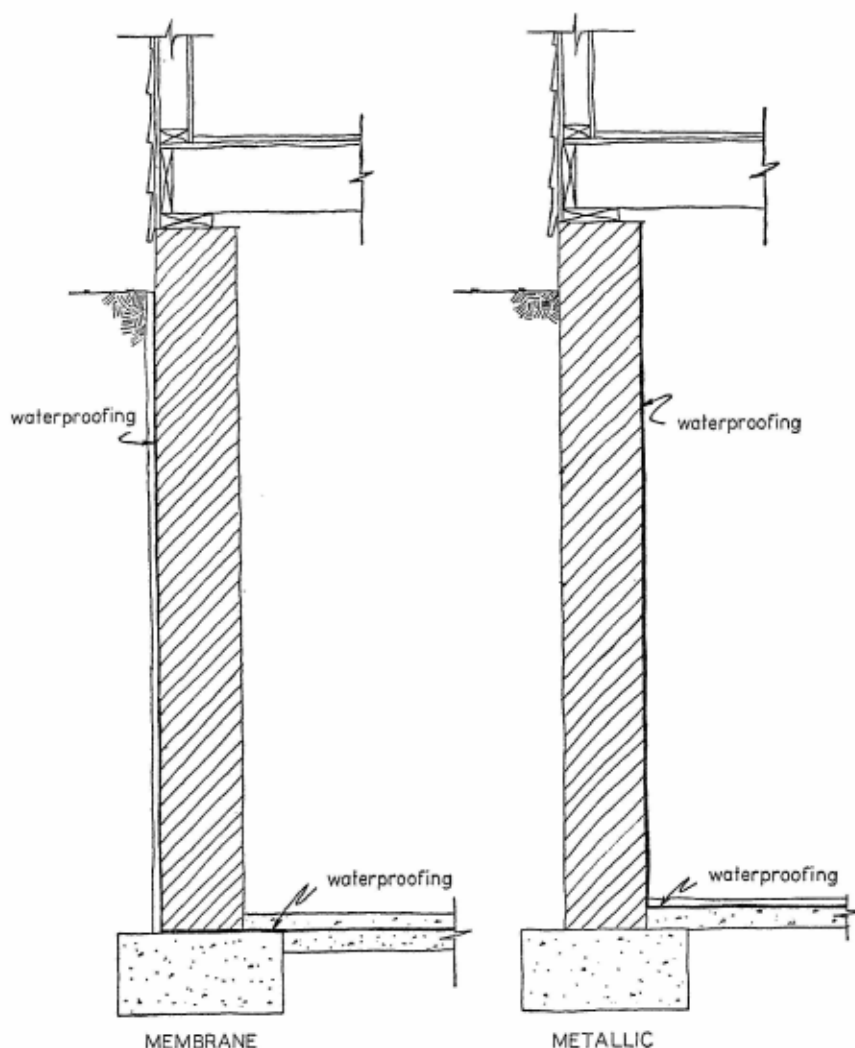


FIG. 15-1 WATERPROOFING

### 15-3 PREPARING THE SURFACES FOR THE APPLICATION OF WATERPROOFING

The Contractor should be warned to clean thoroughly the walls and floors, removing fins and loose materials and pointing mortar joints, cracks and holes with mortar, before the waterproofing material is applied.

#### 15-4 METALLIC TYPE WATERPROOFING MATERIAL

Metallic type waterproofing material may be specified to be a finely pulverized powder made from gray cast iron and treated physically and chemically (chemical generally used is sal-ammoniac) to produce the necessary waterproofing qualities through oxidation of the iron particles. It may be wise for the specification writer to include the acceptable products of waterproofing manufacturers by trade names. Sand and cement should be same as specified in *Masonry* section.

#### 15-5 APPLICATION OF METALLIC WATERPROOFING ON WALLS

Metallic type waterproofing is generally applied on the walls in three coats, although more coats are sometimes recommended where there is unusual water pressure. The application should be done in strict accordance with the manufacturer's printed instructions and as follows:

1. *First Coat:* One slush coat of the metallic waterproofing material mixed with cement, sand and water according to manufacturer's directions is usually applied with a brush to force it into the surface and give a good binding.
2. *Second Coat:* After the first coat has properly cured a second slush coat of metallic waterproofing material mixed with cement, sand and water according to manufacturer's directions should be applied with a brush.
3. *Third Coat:* This is generally a plaster coat  $\frac{1}{2}$ " thick of metallic waterproofing material, cement and sand mixed according to manufacturer's directions, applied and then given a smooth float finish.

#### 15-6 APPLICATION OF METALLIC WATERPROOFING ON FLOORS

On the floors the metallic waterproofing is applied directly to the structural slab. The structural slab should be left reasonably rough. This waterproofing is generally applied in not less than three coats thoroughly broomed in and the last coat applied just before the floor finish is poured. The finish (which should be specified in the *Concrete* section) is generally 1" thick of 2,500-lb. concrete and is given a steel trowel finish.

#### 15-7 METALLIC WATERPROOFING FOR MISCELLANEOUS ITEMS

- a. The Waterproofing Contractor should take particular care to caulk and waterproof thoroughly around all pipes, ducts and other protrusions through walls and floors. This caulking is usually done with wool saturated with metallic waterproofing material.
- b. A waterproofing cement cove is usually specified for all corners and at the junction of floors and walls. Where expansion bolts or electrical out-

let boxes are to be set, the recesses to receive them should also be waterproofed before the installation is made.

#### 15-8 MEMBRANE WATERPROOFING MATERIALS

- a. Membrane waterproofing materials are generally specified as follows:
- b. *Creosote Oil* for priming coat may be specified by reference to ASTM Spec. D43 covering creosote for priming coat with coal tar pitch in dampproofing and waterproofing.
- c. *Felt* may be specified to be coal-tar-saturated felt complying with ASTM Spec. D227 either 36" or 32" wide. This felt should weigh not less than 14 lbs. per 100 sq. ft., exclusive of wrapping and packing.
- d. *Coal Tar Pitch* may be specified by reference to ASTM Spec. D450 and it should be specified as *Type B*, which is the coal tar used as a mopping coat in waterproofing. (*Type A* is used as a mopping coat in the construction of built-up roofing.)
- e. *Fiber-board*: To protect the membrane waterproofing from being damaged during the backfilling operation, protection is sometimes specified. Treated fiber-board  $\frac{1}{2}$ " thick complying with ASTM Specification C208, *Class A* is often used. (*Class A* is building board, *Class B* is lath for plaster base, *Class C* is roof insulation board, *Classes D* and *F* interior boards, *Class E* sheathing and *Class G* shingle backer.)

#### 15-9 APPLICATION OF MEMBRANE TYPE WATERPROOFING

- a. Although less than three plies are often specified, the three-ply system is best for the usual conditions. Where the water pressure is very great, five-ply waterproofing may be specified. For three-ply waterproofing, the surface to be waterproofed should first be primed with creosote oil, using 1 gal. per square. This should be followed with a mop-on coat of coal tar pitch upon which three layers of 32" wide coal-tar-saturated felt is applied, lapping each sheet  $21\frac{1}{2}$ " over the preceding sheet and lapping ends 6". (If 36" felt is used, lap the sheets 24".) Each sheet should be mopped full width of the lap with hot coal tar pitch, using not less than 25 lbs. per square for each mopping. After this is done, the Contractor should be instructed to mop over the entire surface a uniform coat of hot coal tar pitch, using not less than 50 lbs. per square.
- b. On the floors the membrane waterproofing is applied directly to the structural slab and it should be noted that the waterproofing is to be turned up at all vertical walls or other vertical surfaces. The concrete topping over this membrane waterproofing is specified in the *Concrete* section of the specifications.

### 15-10 CAULKING

In areas where membrane waterproofing is to be applied, the pipes, anchors, ducts and other items that protrude through the floor and walls should be thoroughly caulked with plastic cement.

### 15-11 MEMBRANE WATERPROOFING PROTECTION

When the final coating of pitch has been applied on the exterior walls and before the pitch has cooled, fiber-board sheets (if required) shall be applied to protect the membrane during the backfilling around walls. These fiber-board sheets should be pressed down to secure them in place. The fiber-boards should completely cover all of the membrane waterproofing.

### 15-12 POLYVINYL CHLORIDE

Instead of specifying several layers of felts as the membrane waterproofing of foundation walls, an alternate method is to specify one layer of polyethylene film as follows:

"Walls shall be uniformly coated with hot asphalt or coal tar or asphalt emulsion. Apply 10-mil (0.01") polyvinyl chloride film in a continuous strip horizontally around the foundation walls and bring film down over tops of footings. Horizontal joints shall be shingle lapped at least 6" and sealed."

### 15-13 GUARANTEE

There are certain waterproofing companies in a position to guarantee their installation for a period longer than one year, and the specification writer may wish to state that

"The Owner shall be furnished a written guarantee that the areas waterproofed under this contract are and will remain watertight for a period of 5 years from the date of final acceptance."



## CHAPTER 16

### Miscellaneous Metal Work

---

#### 16-1 GENERAL

All metal items for residential work may be placed in one section of the specifications entitled *Miscellaneous Metal Work*, with the exception of the following:

- a. *Reinforcing Steel*, customarily specified in *Concrete* section.
- b. *Nails, Bolts, Screws, Fastenings and Ties*, usually specified in the respective sections covering the material to be secured.
- c. *Finish Hardware*, usually set up to be purchased under an allowance and installed in the *Finish Carpentry* section or specified in a separate section entitled *Finish Hardware*.
- d. *Sheet Metal* for roofs, flashing and termite shields, always specified in *Roofing and Sheet Metal* section.
- e. *Metal Lath and Metal Plastering Accessories*, always specified in *Lathing and Plastering* section.
- f. *Metal Bath Room Accessories*, usually set up to be purchased under an allowance and installed in *Marble and Tile* section.
- g. *Metal Work of the Mechanical Trades*, customarily specified in the *Plumbing, Heating, Air Conditioning and Electrical* sections.

#### 16-2 SHOP DRAWINGS

If only a few lintels and standard type ventilators, cleanout doors, etc., are to be used, the specification writer should not require shop drawings. If there are special shapes and designs, then the specification writer should require shop drawings to be submitted to the Architect for approval before fabrication is started.

#### 16-3 STRUCTURAL STEEL

Structural steel may be specified simply by reference to the ASTM Spec. A7 covering structural steel for bridges and buildings (or Fed. Spec. QQ-

S-741a, *Grade B*, Class and Type best suited for the work). If the steel is used in connection with framing, mention should be made of punching the steel to receive wood nailing strips where indicated. The punching is usually specified for  $\frac{1}{2}$ " bolts not more than 3' 0" o.c.

#### 16-4 FLITCH PLATES

- a. *Use:* Flitch plates, formed by sandwiching steel plates between wood members and bolting together, are used in locations where the span is too great to be supported by wood members alone.
- b. *Type and Sizes:* Plates should be made of structural steel and should be punched for bolts. Sizes of flitch plates may be selected from Table 16-1. The drawings should show the location of flitch plates and the specifications should describe them in detail.

#### 16-5 STEEL LINTELS

- a. *Lintels for 4" Veneer:* Steel lintels have to be provided for square head openings in 4" masonry veneer, and these are often specified to be  $3\frac{1}{2}$ " x  $3\frac{1}{2}$ " x  $\frac{1}{4}$ " angles with 4" bearing at each end for openings under 7' 0". Other sizes may be selected from Table 16-2 unless there is an unusual load condition above these lintels.
- b. *Lintels for 8" Masonry:* For residential work steel angle lintels are sometimes necessary for 8" masonry square head openings into a garage. If the opening is a typical 8-ft. opening, the specification writer may specify this to be two 5" x  $3\frac{1}{2}$ " x  $\frac{5}{16}$ " angles with 5" bearing at each end. Lintels for 8" masonry other than this may be selected from Table 16-2, unless there is an unusual load condition above these lintels.
- c. *Lintels for 12" Masonry:* If steel lintels are required for 12" masonry openings, they may be specified and selected from Table 16-2, unless there is an unusual load condition above these lintels.

#### 16-6 PIPE COLUMNS

- a. *Use:* Pipe columns are frequently used in basement for supporting first-floor wood beams and are generally spaced not over 8' 0" apart along the line of the beams. The location of pipe columns is indicated on the basement floor (or foundation) plan.
- b. *Type and Size:* Columns may be specified to be made of Standard Weight (or Extra Strong) steel pipe 4" in diameter complying with ASTM Spec. A120 (or Fed. Spec. WW-P-404a, Type best suited for the work). A 4" standard weight pipe column is usually more than sufficient for a residence; other sizes may be selected from Table 16-3.
- c. *Cap and Base:* Cap piece for pipe columns is specified to be of cast iron or steel plate with at least two lag screw holes provided for attaching to

TABLE 16-1. FLITCH PLATES

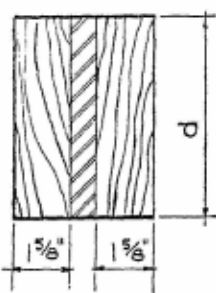


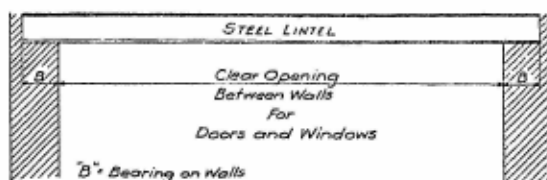
Diagram illustrating the flitch plate joint. The left plate is labeled "2- 3/4\" BOLTS EACH END". The right plate is labeled "3/4\" BOLTS 2'-0\" O.C. STAGGERED". The joint is shown with a depth dimension 'd' and a width dimension of 1 5/8\".

TOTAL UNIFORM SUPERIMPOSED LOADS IN POUNDS\*

Span (ft.)	Depth (d)	Plate Thickness						
		3/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
10	7 1/2	4,760	6,160	7,570	9,070	10,380	11,790	13,200
	9 1/2	7,630	9,890	12,150	14,400	16,660	18,920	21,170
	11 1/2	11,180	14,490	17,800	21,100	24,410	27,720	31,020
11	7 1/2	4,320	5,600	6,880	8,250	9,420	10,700	11,980
	9 1/2	6,920	8,980	11,010	13,100	15,120	17,200	19,200
	11 1/2	10,150	13,170	16,200	19,180	22,200	25,200	28,200
12	7 1/2	3,960	5,130	6,300	7,550	8,640	9,800	10,980
	9 1/2	6,350	8,230	10,110	12,000	13,900	15,780	17,600
	11 1/2	9,310	12,040	14,810	17,590	20,350	23,050	25,850
13	7 1/2	3,660	4,740	5,820	6,970	8,000	9,050	10,120
	9 1/2	5,860	7,600	9,340	11,080	12,800	14,520	16,250
	11 1/2	8,600	11,120	13,700	16,210	18,790	21,300	23,850
14	7 1/2	3,400	4,400	5,400	6,480	7,400	8,410	9,410
	9 1/2	5,450	7,050	8,660	10,300	11,900	13,500	15,100
	11 1/2	7,990	10,310	12,700	15,060	17,420	19,800	22,180
15	7 1/2	3,180	4,100	5,050	6,050	6,900	7,850	8,780
	9 1/2	5,080	6,580	8,100	9,600	11,100	12,600	14,100
	11 1/2	7,460	9,650	11,870	14,070	16,290	18,450	20,700
16	7 1/2	2,980	3,840	4,730	5,660	6,480	7,360	8,240
	9 1/2	4,760	6,170	7,600	9,000	10,400	11,810	13,200
	11 1/2	6,980	9,040	11,110	13,200	15,260	17,300	19,400
17	7 1/2	2,800	3,620	4,450	5,340	6,100	6,910	7,750
	9 1/2	4,480	5,800	7,140	8,460	9,800	11,120	12,420
	11 1/2	6,580	8,510	10,480	12,400	14,360	16,300	18,250
18	7 1/2	2,640	3,420	4,200	5,040	5,760	6,540	7,320
	9 1/2	4,240	5,480	6,750	8,000	9,250	10,500	11,720
	11 1/2	6,210	8,040	9,890	11,710	13,570	15,390	17,250
19	7 1/2	2,500	3,240	3,980	4,770	5,450	6,200	6,930
	9 1/2	4,000	5,200	6,390	7,560	8,760	9,960	11,110
	11 1/2	5,890	7,610	9,360	11,100	12,850	14,580	16,320
20	7 1/2	2,380	3,080	3,780	4,540	5,180	5,880	6,600
	9 1/2	3,810	4,940	6,070	7,200	8,330	9,460	10,580
	11 1/2	5,590	7,240	8,900	10,520	12,200	13,840	15,500

\* Table to be used for Southern Pine or Douglas Fir.

TABLE 16-2. STEEL LINTELS



Clear Opening Between Walls	For 4" Veneer with Wood Backing		For 9" Wall 8 x 1/4" Plate on Bottom		For 13" Wall 12 x 1/4" Plate on Bottom	
		$B$		$B$		$B$
7'-0" and under	3 1/2 x 3 1/2 x 1/4	4"	2-4 x 3 1/2 x 5/16	4"	5" 10 # I	5"
8'-0"	5 x 3 1/2 x 5/16	5"	2-5 x 3 1/2 x 5/16	5"	5" 10 # I	5"
9'-0"	6 x 3 1/2 x 5/16	6"	2-6 x 3 1/2 x 5/16	6"	6" 12.5 # I	6"
10'-0"	7 x 4 x 7/16	7"	6" 12.5 # I	6"	7" 15.3 # I	7"
11'-0"			7" 15.3 # I	7"	8" 18.4 # I	8"
12'-0"			8" 18.4 # I	8"	8" 23 # I	9"
13'-0"			8" 23 # I	9"	10" 25.4 # I	10"
14'-0"			8" 23 # I	9"	10" 25.4 # I	10"
15'-0"			10" 25.4 # I	10"	10" 25.4 # I	10"
16'-0"			10" 25.4 # I	10"	12" 31.8 # I	12"
17'-0"			12" 31.8 # I	12"	12" 31.8 # I	12"
18'-0"			12" 31.8 # I	12"	12" 31.8 # I	12"
19'-0"			12" 31.8 # I	12"	12" 31.8 # I	12"
20'-0"			12" 31.8 # I	12"	12" 31.8 # I	12"
21'-0"			15" 42.9 # I	12"	15" 42.9 # I	12"
22'-0"			15" 42.9 # I	12"	15" 42.9 # I	12"
23'-0"			15" 42.9 # I	12"	15" 42.9 # I	12"

TABLE 16-3 CAPACITY OF ROUND PIPE COLUMNS IN 1000 LBS.\*

Size of Pipe "D"	Thick- ness	Weight per Foot	Size of Base	UNSUPPORTED LENGTH OF COLUMNS															
				7 Ft.	8 Ft.	9 Ft.	10 Ft.	11 Ft.	12 Ft.	13 Ft.	14 Ft.	15 Ft.	16 Ft.	17 Ft.	18 Ft.	19 Ft.	20 Ft.		
3"	.22	7.58	7x 7x%	26	24	22	19	17											
3½"	.23	9.11	8x 8x%	34	31	29	27	25	22	20									
4"	.24	10.79	8x 8x%	41	40	38	35	33	30	28	25	22							
4" XII	.34	14.08	10x10x%	57	55	52	48	44	41	37	34	30							
4½"	.25	12.54	10x10x%	48	48	46	44	41	38	36	33	31	28						
4½" XII	.35	17.61	10x10x%	67	67	65	61	57	53	49	46	42	38						
5"	.26	14.62	12x12x%	56	56	56	54	52	49	46	43	41	38	35	32				
5" XH	.38	20.78	14x14x1	79	79	79	76	72	68	64	60	56	52	48	44				
6"	.28	18.97	14x14x1	73	73	73	73	73	70	67	64	61	58	55	52	49	46		
6" XH	.43	28.57	14x14x1	109	109	109	109	109	105	100	95	91	86	82	77	72	68		
7"	.30	23.54	14x14x1	90	90	90	90	90	90	90	87	84	80	77	74	71	68		
8"	.28	25.0	14x14x1	109	109	109	109	109	109	109	109	108	105	101	98	94	91		

These Round Steel Pipe Columns are preferred by Many where the column is left exposed in the building. The cost of these columns is somewhat more than the H-column sections.

\* Courtesy of Converse Steel and Bridge Co.

frame construction. Base plates are specified to be 8" x 8" x  $\frac{5}{8}$ " welded to bottom. Other sizes of base plates may be selected from Table 16-3.

## 16-7 PIPE RAILINGS

- Use:** Pipe railings used frequently for industrial work are sometimes used for residential work, around large areaways, exterior stair wells, at top of retaining walls and similar locations to serve as a permanent guard.
- Type and Size:** Pipe rails are usually constructed of 1 $\frac{1}{2}$ " I.D. Standard Weight Steel Pipe meeting the requirements of ASTM Spec. A120 (or Fed. Spec. WW-P-404a, Type best suited for the work), 3' 0" high with two horizontal rails and with uprights spaced not over 8' 0" o.c.
- Fittings:** When pipe rails were first used, ball type fittings were employed, but now the specification writers generally call for flush type fittings to be used or the pipe to be bent, fitted and welded with all welds ground smooth.
- Installation:** Pipe work is often specified to be fastened to masonry by flanges and expansion bolts and to concrete in 4" sleeves and caulked with grout, molten sulfur, or molten lead; lead wool may be used for anchoring, where the tendency to flow is not a factor involving strength. Posts may be specified to have slip flanges.
- Galvanizing:** If pipe rails are for exterior installation, it is good practice to specify them to be hot-dip galvanized after fabrication in accordance

with ASTM Spec. A123 (this standard specification requires a zinc coating averaging not less than 2.0 oz. per sq. ft.) and treated chemically to provide a phosphate paint holding film.

### 16-8 HANGING RODS

- a. *Use:* Hanging rods are usually specified for all clothes closets where indicated on the drawings.
- b. *Type and Size:* Hanging rods are often specified to be made of  $\frac{3}{4}$ " galvanized steel pipe meeting the requirements of ASTM Specification A120. It is cheaper to support these by holes or slots in the wood cleats supporting the wood shelf above; they also can be threaded and supported by metal flanges screwed to the cleats. If the specification writer prefers chromium-plated rods, these may be specified and selected from catalog of a manufacturer specializing in closet accessories.

### 16-9 METAL VENTILATORS (See Figure 16-1)

- a. *Use:* Perforations are left in the masonry foundation walls of cheap speculative buildings to provide ventilation; but on better type of work metal ventilators are specified. The Elevations and Basement Floor (or Foundation) Plan generally show the location of ventilators. They are placed in the exterior foundation walls of a frame building to provide

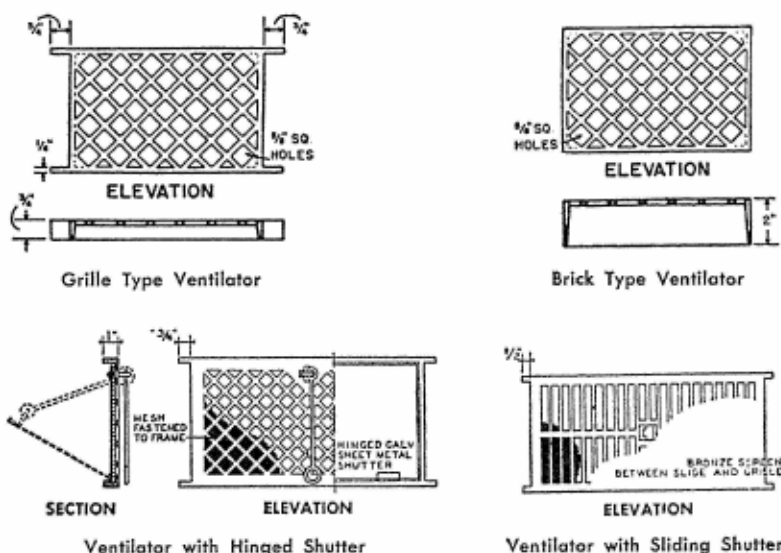


FIG. 16-1 METAL VENTILATORS (Courtesy of Craft Engineering Company)

ventilation through *unexcavated* portions, thus preventing the rotting of timber and discouraging certain types of insects.

- b. *Type and Size:* The ventilators may be specified to be made of cast iron to meet the requirements of ASTM Spec. A48, Class best suited for the work (or Fed. Spec. QQ-I-652a, Class best suited for the work) or made of Alcoa 43 alloy cast aluminum. Reference may be made to a manufacturer's particular pattern, and size and type should be mentioned.

1. *Grille Type:* 8" x 16" (or 8" x 12").

2. *Brick Type:* 5" x 8" (2½" x 8" or 5" x 12").

- c. *Screens:* To keep insects out of the ventilators the specifications should call for No. 14 x 18 mesh bronze (or aluminum) screen to be fastened to frame.
- d. *Shutter:* To permit the ventilators to be closed during extremely cold weather the specifications should call for a galvanized sheet steel (or aluminum) shutter on the ventilators with means provided for opening and closing the shutters from the outside.

#### 16-10 WROUGHT IRON

- a. *Use:* Wrought iron is occasionally used for exterior railings and grilles. Locations are usually shown on the drawings.
- b. *Type:* Genuine wrought iron is a fibrous iron to which have been added iron silicates (a particular type of glass-like slag). This wrought iron resists rust more than mild steel. If the mild steel is not acceptable to the specification writer, he may specify genuine wrought iron bars to meet the requirements of ASTM Spec. A207 (or Fed. Spec. QQ-I-686b).
- c. *Size:* If not clearly indicated on the drawings, the specification writer should give the sizes and heights of members. For a railing of conventional type the sizes and heights might be:

Hand Rail: ½" x 1¾" on 1" x ⅜" x ⅛" channel

Balusters: ½" square spaced 5" o.c.

Newels: ¾" square

Heights: 2' 6" for rails at steps and 2' 8" for rails at platform.

- d. *Installation:* Mention should be made of the method of fastening. Balusters and newels are usually set in holes approximately 3" deep in masonry and caulked with molten lead or lead wool.
- e. *Slip Flanges* are sometimes required for newels and balusters to cover the joints where they enter the masonry.

**16-11 FIREPLACE DAMPERS (Figure 14-6)**

- a. *Use:* Fireplace dampers permit control of draft and provide a means for the flue of a fireplace to be closed to prevent heat loss when the fireplace is not in use. Fireplace dampers should be specified for all fireplaces (except exterior fireplaces, if any).
- b. *Type and Size:* Dampers are constructed with cast iron frames and steel plate valves. The size of the dampers should be for the fireplace widths indicated on the drawings. The damper may be specified by reference to a catalog number or by only mentioning the type of control. Control most often specified is "poker control." Other controls include: lever, rotary, handle and chain—all operated by hand.

**16-12 FIREPLACE LINTEL**

Often a steel lintel is used in connection with the fireplace design. If so, these lintels should be specified and are usually 3" x 3" x  $\frac{3}{16}$ " with 3" bearing at each end for fireplaces up to 42" wide; 4" x 3" x  $\frac{1}{4}$ " for fireplaces up to 60" wide; and 5" x 3 $\frac{1}{2}$ " x  $\frac{5}{16}$ " for fireplaces up to 72" wide.

**16-13 ASH DUMP (Figure 14-6)**

- a. *Use:* Ashes in a fireplace can be dumped directly through an ash dump into an ash pit below and may be cleaned out periodically through a cleanout door. The ash dump is usually made of cast iron. Ash dump should be specified where it is possible to install an ash pit below the fireplace.
- b. *Type and Size:* Ash dumps are specified to have single or double lid and are usually specified to be 5" x 8". Ash dumps are also made in other sizes.

**16-14 CLEANOUT DOORS (Figure 14-5)**

- a. *Use:* Cleanout doors in residential work are usually installed to give access to ashes in ash pits and to provide means of cleaning out the bottom of furnace or boiler flues. Cleanout doors are specified to be furnished and installed where indicated on the plans.
- b. *Type and Size:* The cleanout doors may be specified by reference to a catalog number or the doors and frames may be specified to be made of heavy formed steel 8" wide and 8" high. Cleanout doors are also made in many other sizes.

**16-15 COAL CHUTE**

- a. When a coal-fired furnace or boiler is used, it is usually necessary to provide a coal chute.



1. *Where to Specify:* Coal chutes are generally located in the outer wall of the coal bin or on the grade just outside of the wall of the coal bin.
2. *Type and Size:* Coal chutes may be specified by reference to a catalog number or by mentioning that they are to be constructed of steel or malleable iron and are to be wall type or grade type coal chute, giving the size as selected. If the coal chute is to have an extended hopper, this should be specified to be made of 12 or 14 gauge steel.

## 16-16 METAL WINDOWS

Wood windows have been used in frame buildings more than metal windows except for basement windows. Some architects, however, use metal windows in frame buildings throughout, and for this reason steel windows and aluminum windows are included herein.

## 16-17 STEEL WINDOWS

- a. Steel windows are generally manufactured of fairly standard shapes and sizes, and the specifications should state that they shall meet the requirements of the standards of the Steel Window Institute. The following are the most usual types of steel windows:
  1. *Residence Casements:* Generally used for residences.
  2. *Intermediate Casements:* Generally used for commercial, institutional and public buildings.
  3. *Basement and Utility Windows:* Generally used in basement walls of residences.
  4. *Intermediate Projected:* Generally used for commercial, institutional and public buildings.
  5. *Intermediate Combination:* Generally used for hospitals, institutional buildings and office buildings.
  6. *Commercial Projected:* Generally used for industrial buildings.
  7. *Horizontal Pivoted:* Probably the cheapest type and generally used for industrial buildings.
  8. *Security Windows:* Generally used in commercial and industrial buildings where burglar bars would otherwise be necessary.
- b. *Location:* It is not necessary to specify the location of windows as they are always in exterior walls and show on the drawings of the elevations of the building.
- c. *Type and Quality:* The specification paragraph regarding steel windows should mention the type or types (as noted above). The paragraph could include the names of three or more manufacturers of steel windows whose windows would be acceptable. Mention should be made that the window units are to be complete with frames, mullions, anchors and

glazing clips and shall meet the requirements of the Standards of the Steel Window Institute.

- d. *Sizes:* Sizes of windows should be shown on the drawings and should not be given in the specifications.
- e. *Hardware* for steel windows is specified to be furnished with the steel windows. If bronze hardware is required instead of malleable iron, it should be mentioned.
- f. *Screens:* If the windows are to be screened, the screens should be mentioned; otherwise the Contractor might not include them. Screens are usually specified to be of 14 x 18 mesh of 0.011" bronze wire cloth in steel frames painted to match window frames and complete with necessary operating hardware.
- g. *Storm Sash* are sometimes required for steel windows where weather conditions are severe. They should be specified to be constructed of formed steel and complete with hardware.
- h. *Finish* usually specified for steel windows is to require them to be Bond-erized, then given one coat of gray paint baked-on. *Bonderizing* is a patented rust-proofing treatment.
- i. *Caulking and Glazing* should be specified in a separate section.

#### 16-18 ALUMINUM WINDOWS

- a. *The Aluminum Window Manufacturers Association* has established standard specifications for the manufacture of the following types of aluminum windows:
  - 1. *Type DH-A1:* Double-hung for residential type buildings.
  - 2. *Type DH-A2:* Double-hung for commercial type buildings.
  - 3. *Type DH-A3:* Double-hung for monumental type buildings.
  - 4. *Type C-A1:* Casement for residential type buildings.
  - 5. *Type C-A2:* Casement for commercial type buildings.
  - 6. *Type C-A3:* Casement for monumental type buildings.
  - 7. *Type P-A1:* Projected for residential type buildings.
  - 8. *Type P-A2:* Projected for commercial type buildings.
  - 9. *Type A-A1:* Awning for residential type buildings.
  - 10. *Type A-A2:* Awning for commercial type buildings.
  - 11. *Type HS-A1:* Horizontal sliding (single or double slide) for residential type buildings.
  - 12. *Type VS-A1:* Vertical sliding for residential type buildings.
  - 13. *Type J-A1:* Jalousie for residential type buildings.
- b. *Location:* Windows are shown on the elevations and there is no need to specify the location unless more than one type of window is indicated.
- c. *Type:* Aluminum windows are easily specified by mention of the type

or types and a statement that they shall comply with the specifications of the Aluminum Window Manufacturers Association. The specification writer may limit the Contractor to using aluminum windows of certain manufacturers by naming them. Mention should be made that the window units are to be complete with frames, mullions, operating hardware, anchors and glazing clips.

- d. *Sizes:* Size of windows should show on the drawings and should not be given in the specifications.
- e. *Screens:* All aluminum windows should be screened except possibly the windows in garages. If the screens are for double-hung windows, the specifications should mention whether the screens are to be half vertical sliding or full length. The screens should be of 14 x 18 mesh 0.013" aluminum wire cloth in extruded aluminum frames. Screens should be rewirable and should be equipped with necessary operating hardware.
- f. *Storm Sash* are sometimes required for windows where weather conditions are severe. They should be specified to be constructed of extruded aluminum and equipped with necessary hardware.
- g. *Caulking and Glazing* should be specified in a separate section.

#### 16-19 SHOP COAT

It is usually specified in the miscellaneous metal section that all ferrous metal be given one shop coat of red lead and oil paint except as otherwise specified. All ferrous metals to be built into masonry or concrete are sometimes specified to be covered with asphalt paint or to be galvanized. Other types of paint specified for shop coat include blue lead oil paint and aluminum paint.

## CHAPTER 17

# Rough Carpentry

### 17-1 GENERAL

It is probable that the Contractor may purchase his framing lumber and boards from a lumber yard and his finish material from a millwork plant. Therefore, it is advisable to separate rough carpentry and finish carpentry into two sections. Items of woodwork which would be fabricated at the mill should be omitted from the rough carpentry section.

### 17-2 LUMBER

a. *Lumber*: In selecting lumber for rough woodwork, the specification writer, for economy, should select species prevalent in the region where the building is to be constructed, provided the species are suitable for framing and sheathing. Table 17-1 shows the most popular species of

TABLE 17-1. LUMBER PRODUCTION

Listed in order of 1956 production in U. S.; figures represent Millions of Board Feet, Lumber Tally.

<i>Softwood</i>	<i>Hardwood</i>
Douglas Fir.....	Oak.....
Southern Yellow Pine.....	Yellow Poplar.....
Ponderosa Pine.....	Maple.....
White Fir.....	Sweet Gum.....
Hemlock, Western and Eastern....	Black and Tupelo Gum.....
Eastern White Pine <sup>a</sup> .....	Cottonwood and Aspen.....
Redwood.....	Beech.....
Engelmann and Blue Spruce.....	Elm.....
Sugar Pine.....	Birch.....
Larch.....	Ash.....
Western Red Cedar.....	Basswood.....
Other Softwood <sup>b</sup> .....	Other Hardwood <sup>c</sup> .....
10,414	3,716
7,414	690
3,663	568
2,099	529
1,568	364
1,105	327
991	226
579	198
390	144
346	125
334	119
777	559

<sup>a</sup> Includes Jack and Norway (Red) and Idaho Pine.

<sup>b</sup> Includes Incense Cedars other than Western Red, Lodge Pole Pine, Eastern Spruce, Sitka Spruce and Tamarack.

<sup>c</sup> Includes Alder, Cherry, Hickory and Foreign species (except Canadian).

Taken from: 1956 "Census of Manufacturers" Product Supplement. U. S. Department of Commerce, Bureau of the Census, Washington, D. C.

lumber produced in the United States in one year. The paragraph covering lumber generally should mention that the lumber used for rough woodwork shall be new; shall be S4S (surfaced 4 sides) and shall be AD (air dried) to a moisture content not exceeding 19%.

- b. *Softwood Lumber* is generally used for all rough carpentry work. It should be mentioned that softwood lumber shall comply with R16,

TABLE 17-2. BASIC CLASSIFICATION OF YARD LUMBER

Total products of a typical log arranged in series according to quality as determined by appearance and use.	SELECT	Lumber of good appearance and finishing qualities.	Suitable for natural finishes.	Grade A.—Practically clear. Grade B.—Of high quality—generally clear.
			Suitable for paint finishes.	Grade C.—Adapted to high-quality paint finishes. Grade D.—Intermediate between higher finishing grades and common grades, and partaking somewhat of the nature of both.
	COMMON	Lumber not of finishing quality, but which is suitable for general utility and construction purposes.	Suitable for use without waste.	No. 1.—Sound and tight knotted. May be considered watertight. No. 2.—Less restricted in quality than No. 1, but of the same general character.
			Permitting some waste.	No. 3.—Prevailing grade characteristics larger than in No. 2. No. 4.—Low quality. No. 5.—Lowest recognized grade, but must be usable.

Source: Simplified Practice Recommendation R16-39, U. S. Dept. of Commerce.

American Lumber Standard. Softwood lumber used for light frame construction comes from the Common division of Yard lumber; see Table 17-2. When sizes of pieces are referred to in specifications, nominal dimensions are used and these dress to thickness shown in Table 17-3.

1. *Framing Lumber*: Yard lumber 2" to (but not including) 5" thick and of any width is referred to as *Dimension* lumber. Yard lumber 5" or more in the least dimension is referred to as *timbers*. Dimension lumber and timbers used for framing members should be specified by species, association and grade of lumber.

(a) *Species* of lumber for framing may be selected from Table 17-4.

(b) *Grade and Association* for the species of lumber for framing may be selected from Table 17-5.

TABLE 17-3. MINIMUM STANDARD SIZES OF COMMON YARD LUMBER

THICKNESS (IN.)		WIDTH (IN.)	
Nominal	Dressed	Nominal	Dressed
1.....	$3\frac{1}{4}$	2.....	$1\frac{5}{8}$
$1\frac{1}{4}$ .....	$1\frac{1}{16}$	3.....	$2\frac{5}{8}$
$1\frac{1}{2}$ .....	$1\frac{3}{16}$	4.....	$3\frac{1}{2}$
2.....	$1\frac{3}{8}$	5.....	$4\frac{1}{2}$
$2\frac{1}{2}$ .....	$2\frac{1}{8}$	6.....	$5\frac{1}{2}$
3.....	$2\frac{3}{8}$	7.....	$6\frac{1}{2}$
4 (Pine).....	$3\frac{5}{8}$	8.....	$7\frac{1}{2}$
4 (Fir).....	$3\frac{1}{2}$	9.....	$8\frac{1}{2}$
		10.....	$9\frac{1}{2}$
		11.....	$10\frac{1}{2}$
		12.....	$11\frac{1}{2}$

2. *Sheathing and Other Boards*: Yard lumber less than 2" thick and less than 4" wide is referred to as *strips*. Yard lumber less than 2" thick and 4" wide or more is referred to as *boards*. Strips and boards are used for sheathing, subflooring, grounds and other boards required in rough carpentry work. These members should be specified by species, association and grade of lumber.

(a) *Species* of lumber for sheathing and other boards may be selected from Table 17-4.

(b) *Grade and Association* for the species of lumber for sheathing and other boards may be selected from Table 17-5.

c. *Hardwood Lumber* is seldom used or specified for rough carpentry work because it is often more expensive and is harder to work than softwood lumber. If it is specified, it should be required to meet the requirements of the standards of the National Hardwood Lumber Association.

1. *Framing Lumber*: Species of hardwood lumber recommended for framing are Ash, Beech, Birch, Maple and Oak; and grades are *No. 1 Dimension* for first choice and *No. 2 Dimension* for second choice.

2. *Sheathing and Other Boards*: Species of hardwood lumber recommended for sheathing and other boards are Ash, Beech, Birch, Chest-

TABLE 17-4. RECOMMENDED SPECIES OF COMMON SOFTWOOD LUMBER FOR ROUGH WOODWORK

Excellent	Good
Southern Pine	Eastern Hemlock
Douglas Fir	Western Hemlock
Western Larch	Eastern Spruce
Tidewater Red Cypress (seldom used)	Sitka Spruce
California Redwood	White Fir
	Northern White Pine (seldom used)
	Ponderosa Pine (seldom used)
	Sugar Pine (seldom used)
	Western White Pine (seldom used)

TABLE 17-5. RECOMMENDED GRADES FOR COMMON SOFTWOOD LUMBER

<i>Lumber</i>	<i>Association</i>	<i>1st Choice for Framing Lumber</i>	<i>2nd Choice for Framing Lumber</i>	<i>1st Choice for Sheathing and Boards</i>	<i>2nd Choice for Sheathing and Boards</i>
Cedar, Northern White	NHPMA	No. 1 Dim. or Merch. Dim.	No. 2 Dim.	Merch. Bds. or No. 2 Bds.	No. 3 Bds. or No. 4 Bds.
Cedar, Western Red	WCLA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Gypress, Tidewater Red	SCMA	No. 1 Dim.	No. 2 Dim.	No. 2 Bds.	No. 3 Bds.
Douglas Fir	WCLA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Douglas Fir	WPA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Fir, White	WPA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Hemlock, Eastern	NHPMA	No. 1 Dim. or Merch. Dim.	No. 2 Dim.	Merch. Bds. or No. 2 Bds.	No. 3 Bds. or No. 4 Bds.
Hemlock, West Coast	WCLA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Larch	WPA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Pine, Idaho White	WPA	—	—	Sterling or Standard	Utility
Pine, Northern White	NLMA	—	—	No. 3 Corn.	No. 4 Corn.
Pine, Northern White	NHPMA	No. 1 Dim.	No. 2 Dim.	No. 3 Bds.	No. 4 Bds. or No. 5 Bds.
Pine, Norway	NHPMA	No. 1 Dim.	No. 2 Dim.	No. 3 Bds.	No. 4 Bds. or No. 5 Bds.
Pine, Ponderosa	WPA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Pine, Southern	SPA	No. 1 Dim.	No. 2 Dim.	No. 2 Bds.	No. 3 Bds.
Pine, Sugar	WPA	—	—	Construction Bds.	Standard Bds. or Utility Bds.
Redwood, Calif.	CRA	Select Heart Dimen- sion	Construction Heart Dim. or Sap Com.	Construction Heart Boards or Sap Com. Boards	No. 3 Bds.
Spruce, Eastern	NLMA	No. 1 Dim.	No. 1 Dim.	No. 1 Bds.	No. 2 Bds.
Spruce, Eastern	NHPMA	No. 1 Dim.	No. 2 Dim.	No. 3 Bds.	No. 4 Bds. or No. 5 Bds.

TABLE 17-5. Continued

<i>Lumber</i>	<i>Association</i>	<i>1st Choice for Framing Lumber</i>	<i>2nd Choice for Framing Lumber</i>	<i>1st Choice for Sheathing and Boards</i>	<i>2nd Choice for Sheathing and Boards</i>
Spruce, Engelmann	WPA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Spruce, Sitka	WCLA	Construction J & P	Standard J & P	Construction Bds.	Standard Bds. or Utility Bds.
Tamarack	NHPMA	No. 1 Dim. or Merch. Dim.	No. 2 Dim.	Merch. Bds. or No. 2 Bds.	No. 3 Bds. or No. 4 Bds.

## ASSOCIATIONS

NLMA	Northeastern Lumber Manufacturers Association, New York, N. Y.
SCMA	Southern Cypress Manufacturers Association, Jacksonville, Fla.
WCLA	West Coast Lumbermen's Association, Portland, Oregon
WPA	Western Pine Association, Portland, Oregon
NHPMA	Northern Hardwood and Pine Manufacturers Association, Green Bay, Wis.
SPA	Southern Pine Inspection Bureau of the Southern Pine Association, New Orleans, La.
GRA	California Redwood Association, San Francisco, California

*Note:* First choice of grade for framing sometimes specified for beams, joists, rafters and headers while the second choice is allowed for all other framing such as studs and plates



nut, Elm, Hackberry and Maple; and grades are *No. 1 Boards* for first choice and *No. 2 Boards* for second choice.

- d. *Grade Marking* by stamping or branding each piece with the grade as determined by a recognized grader of the association is sometimes required for all the lumber to be used in rough carpentry work.

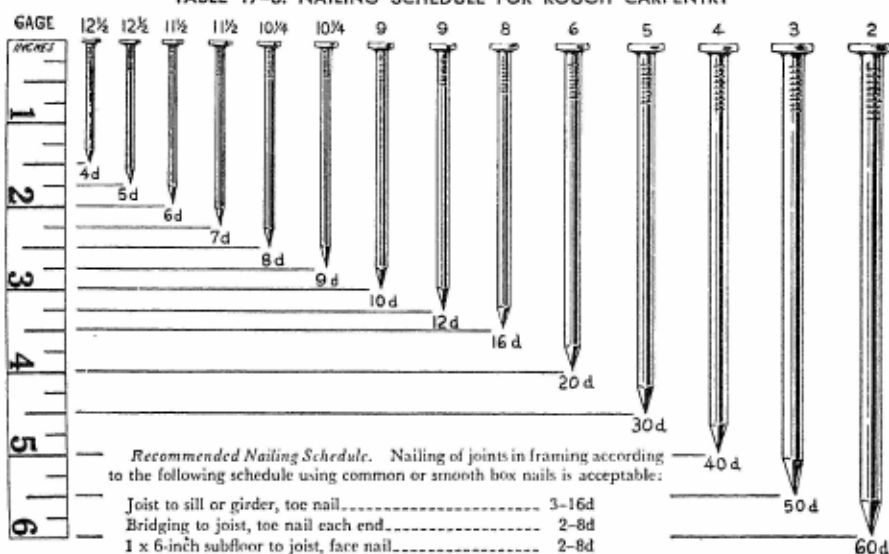
### 17-3 ROUGH HARDWARE

- a. Mention might be made in the specification that bolts, screws and nails should be of proper size to hold members securely in place.
- b. *Bolts* for bolting wood sills to the masonry foundation walls may be specified to be  $\frac{3}{4}$ " (or  $\frac{1}{2}$ ") x 18" (or of proper length to extend into foundation wall at least 8") bolts spaced 6' 0" o.c. (4' 0" o.c.). In certain sections of the country, bolting sills to the foundation walls is not required. Bolts for securing wood nailers to steel members are usually specified to be  $\frac{1}{2}$ " bolts spaced 3' 0" o.c. Washers and nuts should be provided.
- c. *Screws*: Lag screws  $\frac{1}{2}$ " in diameter are usually required for securing steel column caps to wood beams.
- d. *Nails*: Common nails should be used for nailing all joints of rough carpentry work. Specifications do not usually cite the number and size of nails for each type of joint. Table 17-6 is a nailing schedule for reference.

### 17-4 FRAMING

- a. There are three popular types of framing: *Platform Framing*, *Balloon Framing* and *Eastern Braced Framing*. This text deals primarily with Platform Framing which is probably the least expensive. The Contractor should be cautioned by the specifications that all framing lumber shall be closely fitted and accurately set to required lines and levels, and that splicing between bearing points will not be acceptable.
  - 1. *Cutting*: Warn the Contractor in the specifications that where it is necessary to cut framing members for installation of mechanical work, the members so cut shall be properly reinforced with headers the full depth of the member or with steel straps.
  - 2. *Framing Around Chimney Masonry*: Framing members should be kept at least 2" away from chimney masonry. Framing members bearing on chimney masonry should not be permitted.
  - 3. *Spacings* of framing members are conventionally confined to 12", 16" and 24" to fit a 4' 0" module.
- b. *Floor Framing* (Figure 17-1) consists of sills, beams, joists and cross bridging.

TABLE 17-6. NAILING SCHEDULE FOR ROUGH CARPENTRY



*Recommended Nailing Schedule.* Nailing of joints in framing according to the following schedule using common or smooth box nails is acceptable:

Joist to sill or girder, toe nail.....	3-16d
Bridging to joist, toe nail each end.....	2-8d
1 x 6-inch subfloor to joist, face nail.....	2-8d
1 x 8-inch subfloor to joist, face nail.....	3-8d
2-inch subfloor to joist or girder.....	2-20d
Sole plate to joist or blocking.....	20d-16" o. c.
Top plate to stud, end nail.....	2-16d
Stud to sole plate, toe nail.....	3-16d
Doubled studs.....	16d-30" o. c.
Top plates, spike together.....	16d-24" o. c.
laps and intersections.....	3-16d
Ceiling joists, to plate, toe nail.....	2-16d
laps over partitions.....	3-16d
to parallel alternate rafters.....	3-16d
Rafter to plate.....	3-16d
1-inch brace to each stud and plate.....	2-8d
1 x 8-inch sheathing or less, to bearing.....	2-8d
Over 1 x 8-inch sheathing, to bearing.....	3-8d
Corner studs and angles.....	16d-30" o. c.
Other joints, nail to provide proportionate strength.	

Source: "Technique of House Nailing" by U. S. Forest Products Laboratory and Housing and Home Finance Agency and "Minimum Property Requirements," State of Georgia Federal Housing Administration.

1. *Sills* of the box type are generally specified to be of 2" x 8" (2" x 6") plates with 2" headers the same depth as the floor joists. Mortar should be used for leveling plate. Sills should be of treated wood.
2. *Beams* (girders) are often specified to be 4" thick and depth of joists (or of two joists securely nailed together) with 2" x 4" ledgers attached.
3. *Joists*: In many architectural offices the size of floor joists for the longest span is computed and, to simplify construction, this size is used throughout and is often at 16" spacing. The drawings should indicate the exceptions. The specifications, then, could state that all floor joists, except where otherwise indicated on drawings, shall be 2

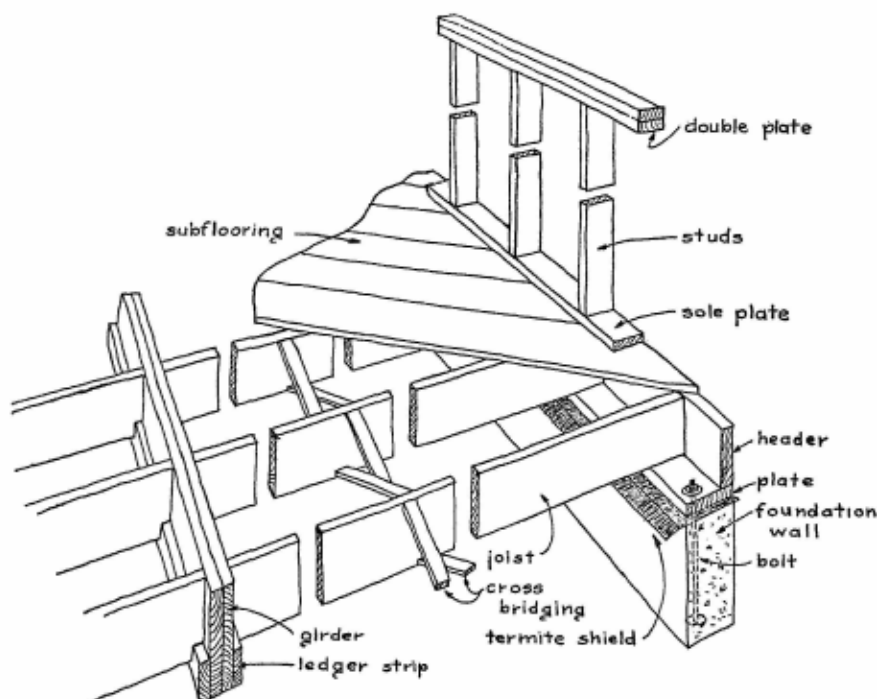


FIG. 17-1 TYPICAL FLOOR AND WALL FRAMING

x 12's (2 x 10's) spaced 16" o.c. Joists should be doubled under all partitions and around stair wells, chimneys and other openings.

4. *Cross Bridging*: To distribute the load placed on one joist to the other joists, cross bridging is used. Joists over 8' 0" in span should be bridged with one row and joists over 16' 0" in span with two rows of 1" x 3" cross bridging cut on bevel and driven up tight. Since cross bridging can be driven up tight, it is far superior to solid bridging.
5. *Termite Shields*: It may be mentioned that termite shields are specified in *Roofing and Sheet Metal* section.
- c. *Wall and Partition Framing* (Figure 17-1) consists of sole plate, studs and double top plates. Wall framing is generally specified to be of 2 x 4 studs, except where otherwise shown on drawings, spaced 16" o.c. with single sole plate at bottom and double plate at top.
1. *Openings* (Figure 17-2): It should be specified that studs shall be doubled at sides of all openings and spans for headers shall not exceed the following:

Spans up to 3' 6" . . . . .	Two 2 x 4's
Spans 3' 7" to 4' 6" . . . . .	Two 2 x 6's
Spans 4' 7" to 6' 0" . . . . .	Two 2 x 8's
Spans over 6' 0" . . . . .	Two 2 x 10's and braced

2. *Horizontal Blocking*: It is sometimes specified that blocking of 2 x 4's shall be installed in the center of all stud walls and partitions.
3. *Diagonal Bracing* for exterior walls should be specified to give strength if diagonal wood sheathing is not used. Diagonal bracing is generally specified to be of 1" x 4" boards let into the studs at all corners of the house and run diagonally from post to sill.
- d. *Ceiling Framing* after proper computation and selection is generally specified, except where otherwise indicated on drawings, to be of 2 x 10's (2 x 8's) spaced 16" o.c. Suspended ceilings are sometimes specified to be of 2 x 4's spaced 16" o.c. secured to joists or rafters with 2 x 4 hangers spaced not over 20" o.c.
- e. *Roof Framing* (Figure 17-3), after proper computation and selection, is generally specified, except where otherwise indicated on drawings, to be of 2" x 8" (2" x 6") rafters spaced 16" o.c.
  1. *Hip and Valley Rafters and Ridges* are specified to be of 2" stock members and 2" wider than the rafters.
  2. *Wind Beams (Collar Beams)* are often specified to be of 1" x 6" members not less than 8' 0" in length and installed every third rafter.
  3. *Bracing*: It is often necessary to specify rafters to be braced with 4" x 4" uprights 4' 0" o.c. resting on partition plates with supporting wood purlins under rafters.
- f. *Roof Trusses* are being used more and more in place of conventional roof framing. This is particularly true in merchantable house building. This enables putting the job in the dry quickly and the inside partitions can be installed during bad weather. Roof trusses are usually fabricated in a shop and are put together with metal plates or ring fasteners.

## 17-5 GROUNDS

Wood grounds are installed against framing to serve as screeds for plastering and also as a base for securing wood trim and other finishes. The specification writer should specify the grounds to be of wood set for plaster at points where other finish will connect therewith. Grounds should be continuous and set back  $\frac{1}{2}$ " from the exposed edges of overlapping finish. Grounds, except where otherwise shown on drawings, should be  $1\frac{1}{2}$ " wide by thickness selected from the following table:

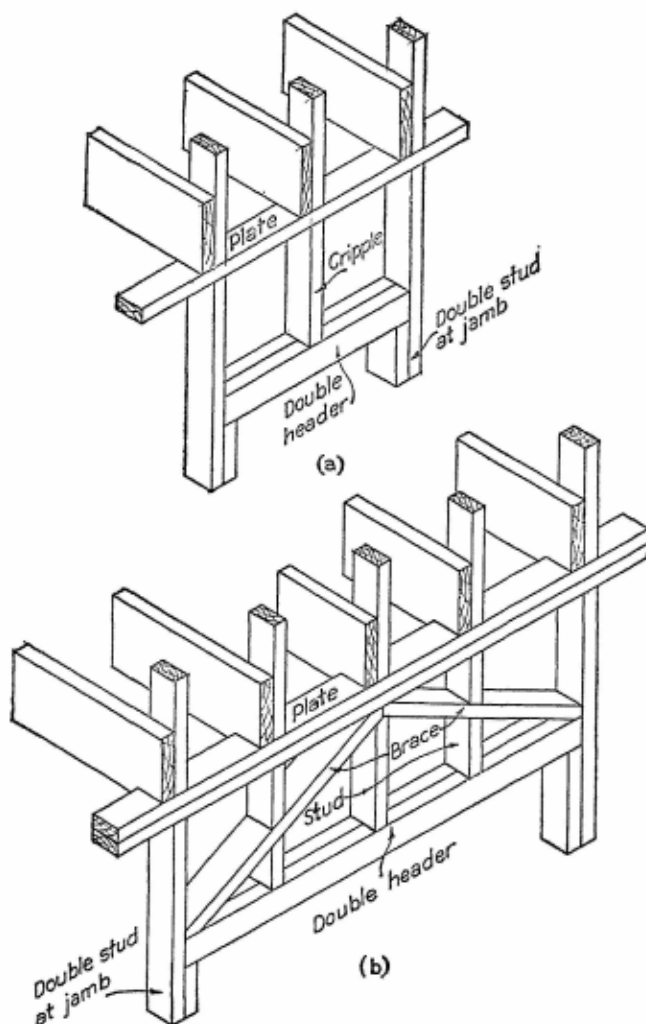
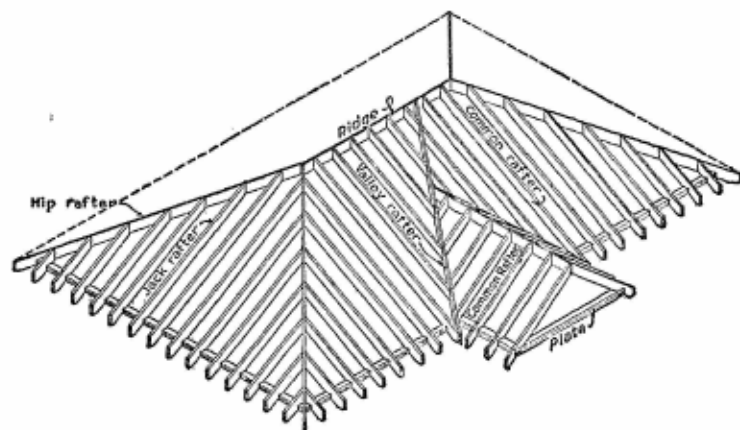


FIG. 17-2 FRAMING ABOVE OPENINGS. (a) Double Header. (b) Trussed or Braced.

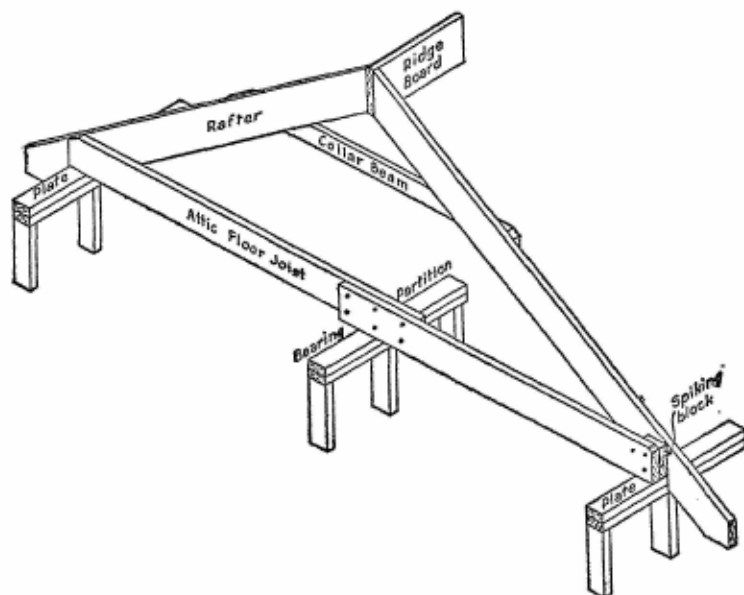
<i>Grounds for</i>	<i>Minimum over Face of Lath</i>	<i>Minimum over Face of Supports</i>
Metal lath, wire lath or wire fabric.....	$\frac{5}{8}$ "	$\frac{3}{4}$ "
$\frac{3}{4}$ " gypsum lath.....	$\frac{1}{2}$ "	$\frac{7}{8}$ "
Masonry surfaces.....	—	$\frac{5}{8}$ "

### 17-6 WOOD FURRING

- $\alpha$ . Since it is not wise to plaster directly to exterior masonry walls, wood furring is often installed to receive the lath and to provide a 1" air space between the lath and the masonry.



Framing Members in Hip Roof



Framing Details of Gable Roof

FIG. 17-3 ROOF FRAMING

- b. *Where to Specify:* For frame buildings wood furring would most likely occur in basement areas to be finished. The specification writer should designate that the interior face of the exterior walls in these areas is to be furred.
- c. *Type and Size:* Furring strips are usually specified to be of 1" x 2" wood

strips. Sometimes these are specified to be treated with a wood preservative.

- d. *Installation:* Strips are usually installed 16" o.c. horizontally or vertically and fastened to metal plugs (see Figure 17-4) placed in the masonry 16" o.c. in one direction and not over 3' 0" in the other direction. Wood plugs should not be used. Furring should be made plumb by shimming out.

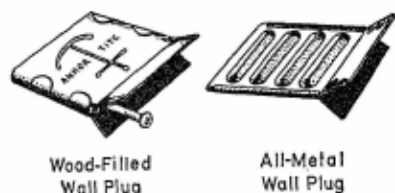


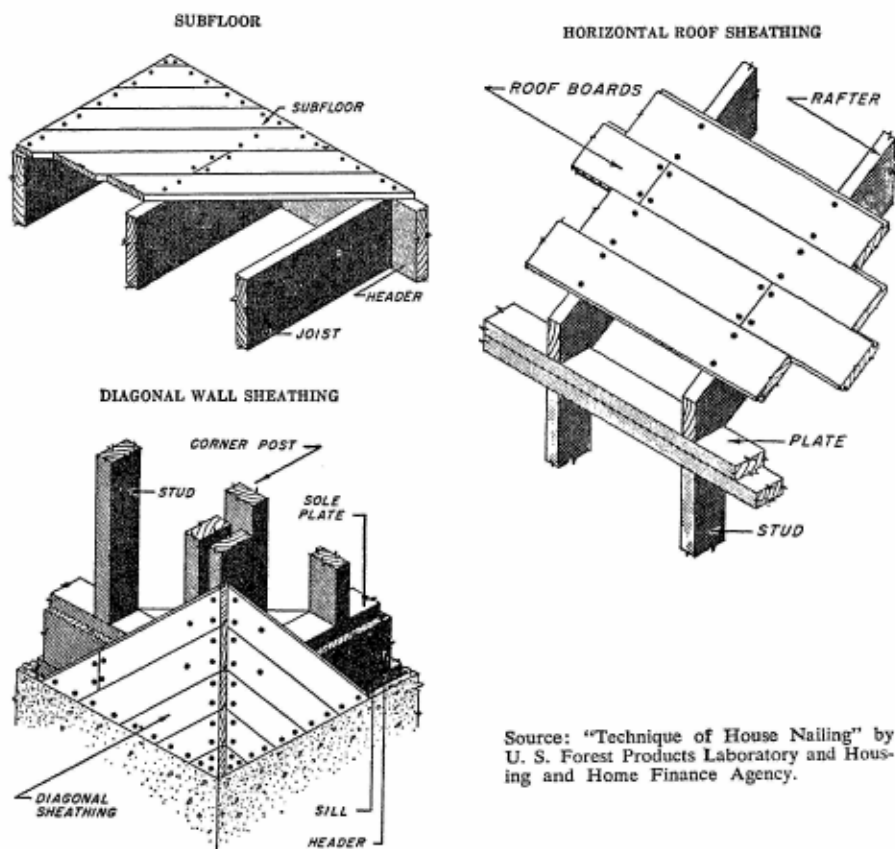
FIG. 17-4 WALL PLUGS

### 17-7 WOOD BUCKS

- a. Rough wood bucks (subframes) are sometimes used in connection with openings in masonry walls to serve as a base for receiving door frames and trim.
- b. *Where to Specify:* Contractor should be instructed to provide rough wood bucks for all openings where wood frames occur in masonry walls.
- c. *Type and Size:* Wood bucks are generally specified to be cut from 2" stock and of widths indicated on drawings.
- d. *Anchor:* Each wood buck should be anchored on each side with at least two anchors usually specified to be  $\frac{1}{8}$ " x  $1\frac{1}{4}$ " metal straps 8" long with ends turned 1".

### 17-8 WOOD SHEATHING (See Figure 17-5)

- a. Wood sheathing consists of boards applied to the framing of a building to serve as a base for the finishes.
- b. *Where to Specify:* Wood sheathing is specified to cover the framing of all exterior walls, the framing of all finished floors and the framing of all roofs.
- c. *Types and Sizes:* Wood sheathing is generally specified to be cut from 1" stock, S4S and not to exceed 8" in width. Although it is not always done, it is better to specify the sheathing for subfloors and roof decking to be T&G.
- d. *Applying Sheathing:* Sheathing is generally specified to be applied diagonally on the walls and floors and horizontally on roofs. Joints should be staggered and should break over the center of supports. Each piece of sheathing should be nailed with at least two 8d nails at each support for sheathing less than 6" wide and at least three 8d nails at each support for sheathing more than 6" wide.
- e. *Other Types of Sheathing* often specified when wood is not readily available or to save labor cost in application include:
1. Plywood sheathing of  $\frac{5}{16}$ " PLYSCORD Grade Douglas Fir



Source: "Technique of House Nailing" by U. S. Forest Products Laboratory and Housing and Home Finance Agency.

FIG. 17-5 WOOD SHEATHING

2. Fiber-board sheathing,  $\frac{1}{2}$ " thick, meeting requirements of Fed. Spec. LLL-F-321b or ASTM Spec. C208, Class E.
3. Gypsum board sheathing,  $\frac{1}{2}$ " thick, meeting requirements of ASTM Spec. C79 or Fed. Spec. SS-S-276

#### 17-9 SHEATHING ATTIC FLOOR

If the building has an attic, it is customary to provide a certain amount of sheathing for flooring storage area. This may be done by the specification writer's mentioning that the Contractor will be required to sheath 250 sq. ft. (or any other figure) of the attic floor.

#### 17-10 FELT

- a. Felt is used between the sheathing and the various finishes.
- b. Use: 15 lb. asphalt-saturated felt complying with ASTM Spec. D226 (or



Fed. Spec. HH-F-191a) is specified for covering the exterior wall sheathing and for covering roof decking when roll roofing, built-up roofing, asphalt shingles or wood shingles are to be used. 30-lb. asphalt-saturated felt is usually specified for covering the roof decking when asbestos shingles, slate or tile are to be used.

- c. *Installation:* Felt should be specified to be lapped at least 4" and temporarily secured in place until finish is applied. Strips of asphalt-saturated felt at least 6" wide should be installed behind exterior trim of all exterior openings.
- d. *Felt for Covering Subflooring:* It might be mentioned that the felt for covering subflooring is specified in the *Flooring* section.

### 17-11 SOIL TREATMENT

- a. In termite infested areas of the United States (see Figure 17-6), the soil should be treated.
- b. *Use:* In frame construction with basement or crawl space, apply 1 gal. of chemicals per 2½ lin. ft. per foot of depth along both sides of foundation walls and around piers, and 1 gal. per 10 sq. ft. under slabs of porches and entrance platforms. In voids of unit masonry foundation walls and piers, use 1 gal. per 5 lin. ft.
- c. *Type:* The chemicals and concentration for treating soils should be one of the following:

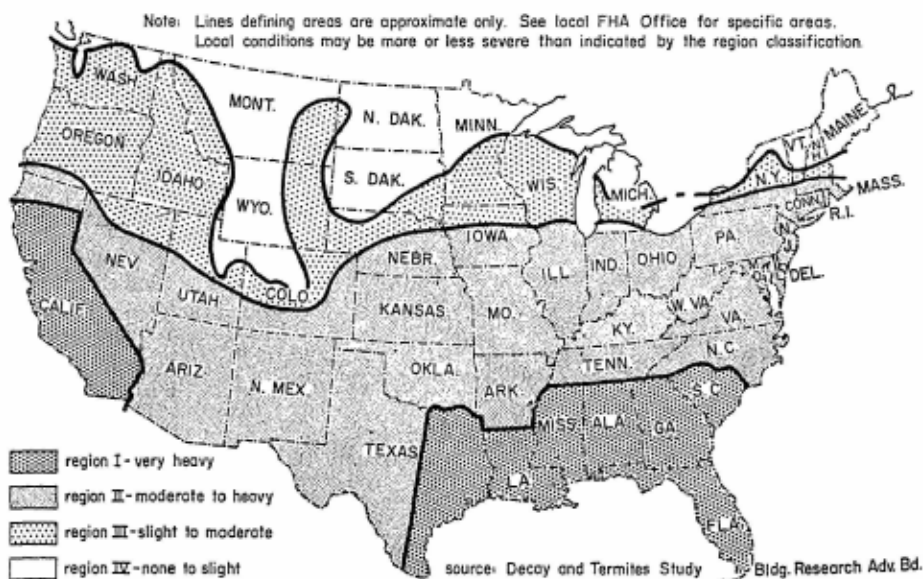


FIG. 17-6 GEOGRAPHIC DISTRIBUTION OF TERMITE INFESTATION. SOURCE: F.H.A. MINIMUM PROPERTY STANDARDS FOR ONE AND TWO LIVING UNITS, NOV. 1, 1958.

Chemicals	Concentrations
Aldrin.....	0.5% applied in oil solution or water emulsion
Benzene hexachloride.....	0.8% of gamma isomer applied in oil solution or water emulsion
Chlordane.....	1.0% applied in oil solution or water emulsion
Dieldrin.....	0.5% applied in oil solution or water emulsion
DDT.....	8.0% in oil solution
Lindane.....	0.8% in oil solution or water emulsion
Trichlorobenzene.....	1 part to 3 parts oil

- d. *Application:* Treatment should not be made when the soil or fill is excessively wet. Precautions should be taken to prevent disturbance of the treated soil by human or animal contact.
- e. *Guarantee:* The treatment should be guaranteed to be effective against termite infestation for a period of not less than 5 years from date of treatment. Any evidence of reinfestation within the guarantee period should be retreated without cost to the Owner.

#### 17-12 TREATED LUMBER

- a. In decay hazard and termite infested areas of the United States (see Figures 17-6 and 17-7), treated lumber should be specified for certain members.
- b. *Use:* In frame construction with basement or crawl space, treated lumber should be specified for all wood up to and including sill plate, joists,

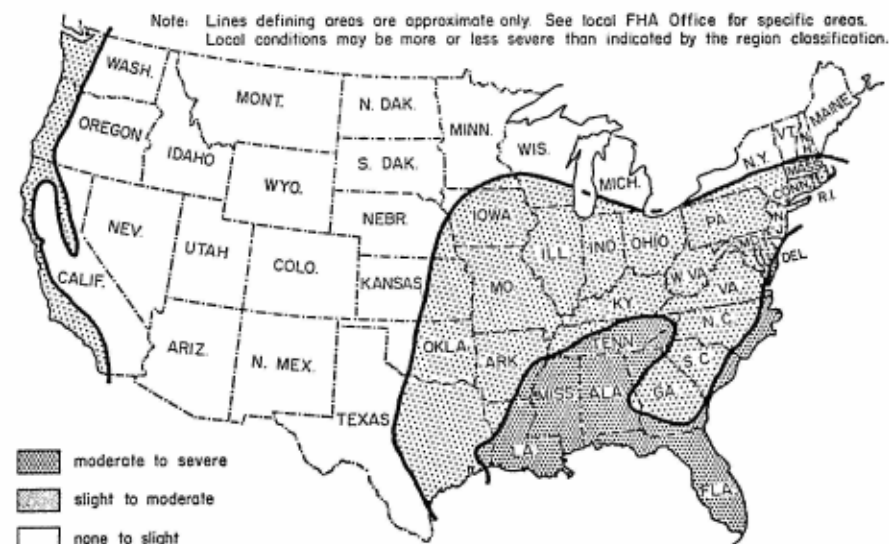


FIG. 17-7 PROBABLE DECAY HAZARD. SOURCE: F.H.A. MINIMUM PROPERTY STANDARDS FOR ONE AND TWO LIVING UNITS, NOV. 1, 1958.

header joists, girders, columns, sole plate, subfloor, and sheathing below first floor line.

- c. *Type:* The wood should be treated by a pressure method (full or empty-cell process) meeting the requirements of Fed. Spec. TT-W-571d "Wood Preservative, Treating Practice," with one of the following preservatives meeting the requirements of the specifications listed:

Wolman salt, Fed. Spec. TT-W-573

Celcure, Fed. Spec. TT-W-546a

Chromated zinc chloride, Fed. Spec. TT-W-551b

Osmosalts, Fed. Spec. TT-W-569

Boliden salt, Fed. Spec. TT-W-538

Pentachlorophenol, Fed. Spec. TT-W-570a

- d. *Installation:* When cutting, notching or drilling is done, treat exposed portions with 95% solution of the same preservative by a 3-min. dip or a thorough brush coating.

## CHAPTER 18

### Finish Carpentry

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#### 18-1 GENERAL

- a. In the *Finish Carpentry* section of a set of specifications one is concerned mainly with woodwork that is exposed after the building is completed. The section covering *Finish Carpentry* for a residence is usually the longest section because the type of work embraces much millwork. On account of the many different species of wood and the many separate grading rules, it is probably the most difficult section to write.
- b. *Omissions*: Because of the numerous items involved in finish carpentry work for most jobs, it may be well to mention in the specifications that all millwork and wood finish required should be provided whether or not every item of work is specifically mentioned within the specifications.
- c. *Shop Drawings*: The specifications should require shop drawings of all millwork which are to be submitted to the Architect for approval before fabrication. Measurements should be taken at the job. Shop drawings need not show items specified to be of standard sizes or shapes.

#### 18-2 FINISH WOODWORK

- a. *Lumber*: In selecting lumber for use in finish woodwork, for economy the specification writer should select species prevalent in the region where the building is to be constructed, provided the species are suitable and of appearance desired for the work involved. The paragraph covering lumber generally should mention that lumber used for finish carpentry shall be new, shall be KD (kiln dried) to a moisture content not exceeding 12% and shall be worked to sizes and profiles shown on drawings.
- b. *Softwood Lumber*: With the exception of flooring, stair treads and hand rails, softwood lumber is used considerably more than hardwood lumber for residential work. It should be mentioned that softwood lumber shall comply with S.P.R. 16 (Simplified Practice Recommendation), American Lumber Standard. Where sizes of pieces of softwood lumber are

referred to in the specifications, the nominal dimensions are used and these dress to thicknesses shown in Table 18-1.

TABLE 18-1. MINIMUM STANDARD SIZES OF FINISH SOFTWOOD YARD LUMBER

THICKNESS (IN.)		WIDTH (IN.)	
Nominal	Dressed	Nominal	Dressed
	$\frac{5}{16}$	3.....	$2\frac{5}{8}$
	$\frac{7}{16}$	4.....	$3\frac{1}{2}$
	$\frac{9}{16}$	5.....	$4\frac{1}{2}$
	$\frac{11}{16}$	6.....	$5\frac{1}{2}$
1.....	$2\frac{5}{32}$	7.....	$6\frac{1}{2}$
$1\frac{1}{4}$ .....	$1\frac{1}{8}$	8.....	$7\frac{1}{4}$
$1\frac{3}{4}$ .....	$1\frac{3}{8}$	10.....	$9\frac{1}{4}$
2.....	$1\frac{5}{8}$	11.....	$10\frac{1}{4}$
$2\frac{1}{2}$ .....	$2\frac{1}{8}$	12.....	$11\frac{1}{4}$
3.....	$2\frac{5}{8}$		

Source: S.P.R. 16, American Lumber Standards for Softwood Lumber, U.S. Department of Commerce.

1. *Exterior Finish Woodwork:* If the majority of the exterior finish woodwork is to be of softwood and given a paint finish, the specification sentence could start: "All exterior finish woodwork, except as otherwise specified, shall be of . . ." and here should be added the grade, species of lumber and the name of the association under whose grading rules the lumber is manufactured. The species of lumber for exterior finish woodwork may be selected from Table 18-3 and the grade and association from Table 18-2.
2. *Interior Finish Woodwork:* If the majority of the interior finish woodwork is to be of softwood to be given paint finish, the specification sentence should start: "All interior finish woodwork, except as otherwise specified, shall be of . . ." and here should be added the grade, species of lumber and the name of the association under whose grading rules the lumber is manufactured. The species of lumber to use for interior finish woodwork may be selected from Table 18-4 and the grade and association from Table 18-2.
3. *Softwood to Receive Natural Finish:* The specification writer should designate items of softwood to be given a natural finish and give the species, grade, the association under which it is produced and, if desired, limit the grain and color.
  - (a) *Species of Lumber* may be selected from Tables 18-3 and 18-4.
  - (b) *Grade and Association* may be selected from Table 18-2.
  - (c) *Grain* (Figure 18-1): When a certain type of grain is desired, it should be specified:
    - (1) *Edge Grain* softwood boards have the majority of annular rings 45 degrees or more with the surface of the pieces.

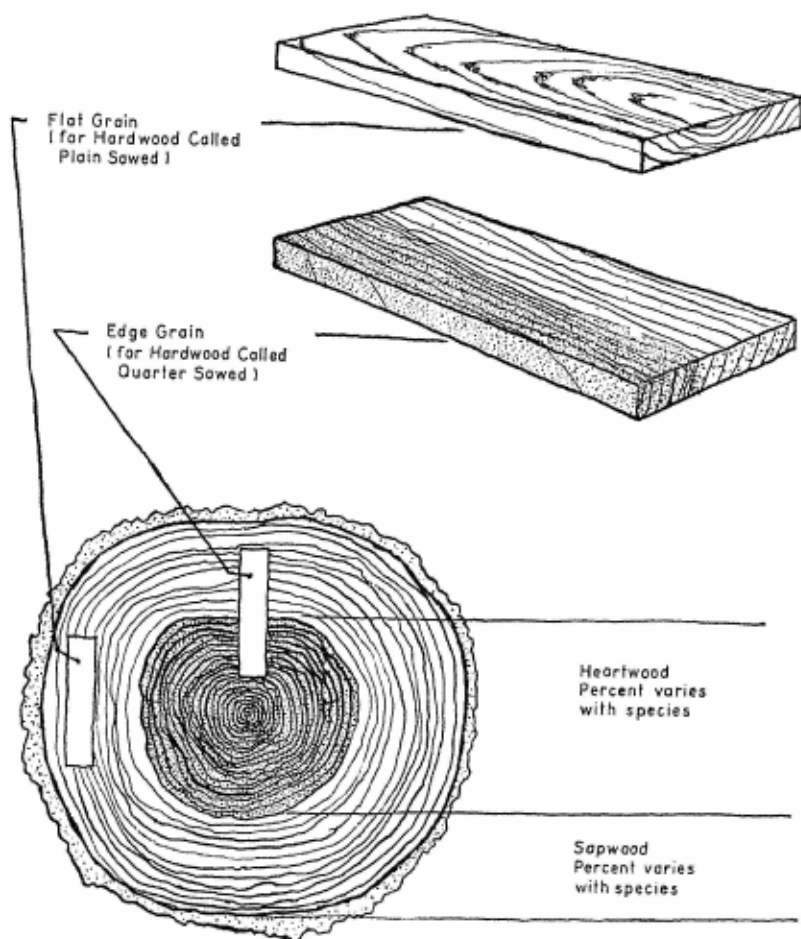


FIG. 18-1 FLAT GRAIN, EDGE GRAIN, HEARTWOOD AND SAPWOOD

- (2) *Flat Grain* softwood boards have the majority of annular rings less than 45 degrees with the surface of the pieces.
- (d) *Color* (Figure 18-1): Lumber is composed of heartwood and sapwood. The heartwood is darker than the sapwood and there is a marked difference between the two in certain softwoods such as redwood, cedar and cypress. For the effect desired the specification writer should designate *All Heartwood* or *All Sapwood* or the lumber will be unselected for color.
- c. *Hardwood Lumber*, because of its added cost as well as the difficulty of working it, is rarely used for woodwork of residences except for flooring,

TABLE 18-2. RECOMMENDED GRADES FOR FINISH OF SOFTWOOD LUMBER

Lumber	Association	1st Choice for Natural Finish	2nd Choice for Natural Finish	1st Choice for Paint Finish	2nd Choice for Paint Finish
Cedar, Northern White	NHPMA	D & Better	No. 1 Boards	No. 1 Boards	No. 2 Boards
Cedar, Western Red	WCLA	B & Better	C Finish	C Finish	D Finish
Cypress, Tidewater Red	SCMA	A Finish	C Select Finish	C Select Finish	No. 1 Boards
Douglas Fir	WCLA	B & Better V.G. or F.G.	C Finish V.G. or F.G.	C Finish V.G. or F.G.	D Finish V.G. or F.G.
Douglas Fir	WPA	B & Better	C Select	D Select	No. 2 Common
Fir, White	WPA	No. 1 & No. 2 Clear	C Select	D Select	No. 2 Common
Hemlock, Eastern	NHPMA	—	—	D Select	No. 1 Boards
Hemlock, West Coast	WCLA	B & Better V.G. or F.G.	C Finish V.G. or F.G.	C Finish V.G. or F.G.	D Finish V.G. or F.G.
Larch	WPA	B & Better	C Select	D Select	No. 1 Common
Pine, Idaho White	WPA	Supreme (B Select & Btr.)	Choice (Select)	Quality (D Select)	Sterling (No. 2 Common)
Pine, Northern White	NLMA	B Select	C Select	C Select	D Select
Pine, Northern White	NHPMA	B Select & Better	C Select	D Select	No. 1 Boards
Pine, Norway	NLMA	B Select	C Select	C Select	D Select
Pine, Norway	NHPMA	B Select & Better	C Select	D Select	No. 1 Boards
Pine, Ponderosa	WPA	1 & 2 Clear (B & Better)	C Select	D Select	No. 2 Common
Pine, Southern	SPA	B & Better	C Grade	C Grade	D Grade
Pine, Sugar	WPA	1 & 2 Clear	C Select	D Select	No. 2 Common
Redwood, Calif.	CRA	Clear All Heart	A Finish	Clear All Heart	A Finish
Spruce, Eastern	NLMA	B & Better	C Select	C Select	Selected Merchant-able

TABLE 18-2—Continued

Lumber	Association	1st Choice for Natural Finish	2nd Choice for Natural Finish	1st Choice for Paint Finish	2nd Choice for Paint Finish
Spruce, Eastern	NHPMA	B Select & Better	C Select	D Select	No. 1 Boards
Spruce, Engelmann	WPA	D & Better	No. 1 & 2 Common	No. 1 & 2 Common	No. 3 Common
Spruce, Sitka	WCLA	B & Better V.G. or F.G.	C Finish V.G. or F.G.	C Finish V.G. or F.G.	D Finish V.G. or F.G.
Tamarack	NHPMA	D & Better	No. 1 Boards	No. 1 Boards	No. 1 Boards

## ASSOCIATIONS

NLMA	Northeastern Lumber Manufacturers Association, New York, N. Y.
SCMA	Southern Cypress Manufacturers Association, Jacksonville, Fla.
WCLA	West Coast Lumbermen's Association, Portland, Oregon
WPA	Western Pine Association, Portland, Oregon
NHPMA	Northern Hardwood and Pine Manufacturers Association, Green Bay, Wis.
SPA	Southern Pine Inspection Bureau of the Southern Pine Association, New Orleans, La.
CRA	California Redwood Association, San Francisco, California



TABLE 18-3. RECOMMENDED SPECIES OF SOFTWOOD  
LUMBER FOR EXTERIOR FINISH WOODWORK

<i>Excellent</i>	<i>Good</i>	<i>Fair</i>
Northern White Cedar*	Eastern Hemlock	Douglas Fir
Southern White Cedar*	Western Hemlock	Western Larch
Western Red Cedar*	Ponderosa Pine	Southern Yellow Pine
Tidewater Red Cypress*	Eastern Spruce	
California Redwood*	Sitka Spruce	
Northern White Pine	Engelmann Spruce	
Sugar Pine	White Fir	
Western White Pine		

\* Heartwood pieces of these species are recommended where decay hazard is high such as trellis work, fence posts, blinds, porch trim and rails.

TABLE 18-4. RECOMMENDED SPECIES OF SOFTWOOD  
LUMBER FOR INTERIOR WOODWORK

<i>Excellent</i>	<i>Good</i>	<i>Fair</i>
Northern White Pine	Eastern Hemlock	Douglas Fir
Ponderosa Pine	Western Hemlock	Western Larch
Sugar Pine	California Redwood	Southern Yellow Pine
Western White Pine	Eastern Spruce	
	Sitka Spruce	
	Engelmann Spruce	
	White Fir	

Note: Softwood lumber is used for interior woodwork where marring is negligible such as in a residence.

TABLE 18-5. MINIMUM STANDARD SIZES OF HARDWOOD LUMBER  
THICKNESS (IN.)

<i>Nominal</i>	<i>Dressed</i>	<i>Nominal</i>	<i>Dressed</i>
1.....	25/32	3.....	2 5/8
1 1/4.....	1 1/8	4.....	3 5/8
1 1/2.....	1 5/8	5.....	4 5/8
2.....	1 5/8	6.....	5 5/8
2 1/2.....	2 1/8	7.....	6 5/8
3.....	2 5/8	8.....	7 1/2
		9.....	8 1/2
		10.....	9 1/2
		11.....	10 1/2
		12.....	11 1/2
		Over 12.....	off 5/8

Source: Rules of the National Hardwood Lumber Association, Chicago, Illinois.

TABLE 18-6. RECOMMENDED SPECIES OF HARDWOOD LUMBER  
FOR EXTERIOR FINISH WOODWORK

<i>Excellent</i>	<i>Good</i>	<i>Fair</i>
Chestnut*	White Ash*	Basswood
White Oak	Black Ash*	Birch
Walnut	Cherry	Huckberry
	Rock Elm*	Hard Maple
		Soft Maple
		Yellow Poplar

Note: Avoid the use of Cottonwood, Black Gum, Sap Gum, Sycamore, Tupelo, Beech, Red Gum, Magnolia and Red Oak on the exterior due to their tendency to warp.

\* These are ring porous hardwoods and are not recommended for paint finish.

stair treads and hand rails, although it is used frequently in commercial work. It should be mentioned that Hardwood Lumber shall comply with the rules of the National Hardwood Lumber Association, Chicago, Illinois. Where size of pieces of Hardwood Lumber are referred to in specifications, the nominal dimensions are used and these dress to standard thicknesses as shown in Table 18-5.

1. *Exterior Finish Woodwork:* The items of exterior woodwork to be of hardwood lumber should be mentioned and the species and grade given:

(a) *Species of Lumber* may be selected from Table 18-6.

(b) *Grade of Lumber* should be one of the following:

*A Finish:* Practically clear but unlimited sapwood admitted unless otherwise specified. Recommended for natural finish.

*B Finish:* Small defects admitted. Recommended for natural finish or paint finish.

*No. 1 Construction*

*Boards:* This grade actually for high-quality sheathing and subflooring but used sometimes for low-cost finish woodwork.

2. *Interior Finish Woodwork:* The items of interior woodwork to be of hardwood should be mentioned and the species and grade given:

(a) *Species of Lumber* may be selected from Table 18-7.

TABLE 18-7. RECOMMENDED SPECIES OF HARDWOOD LUMBER FOR INTERIOR WOODWORK

<i>Excellent</i>	<i>Good</i>	<i>Fair</i>
Birch	Basswood	Ash*
Cherry	Beech	Chestnut*
Walnut	Red Gum	Oak*
Yellow Poplar	Maple	
	Tupelo	

*Note:* Hardwood lumber is used for interior woodwork where marring is likely to occur, as in commercial work.

\* These are ring porous woods and are not recommended for paint finish.

(b) *Grade of Lumber* should be A Finish, B Finish or No. 1 Construction Boards.

3. *Hardwood to Receive Natural Finish:* The specification writer should designate items of hardwood to be given a natural finish and give the species, grade and, if desired, limit the grain and color:

- (a) *Species of Lumber* should be selected from samples for the effects desired. Such hardwoods as Oak, Maple, Red Gum, Birch and Walnut are often used for natural finish.
  - (b) *Grade of Lumber* may be *A Finish*, *B Finish* grade, or special figures and markings such as curly, birdseye, worm holes or knotty may be specified for special effects.
  - (c) *Grain* (Figure 18-1): When a certain type of grain is desired, it should be specified:
    - (1) *Quarter Sawed* (termed *edge grain* in softwood) hardwood boards have the majority of annular rings 45 degrees or more with the surfaces of the pieces. Widest dimension of the wood rays is exposed to view. Quarter sawing produces high resistance of the surface to abrasion, an important factor in flooring.
    - (2) *Plain Sawed* (termed *flat grain* in softwood) hardwood boards have the majority of annular rings less than 45 degrees with the surface of the pieces. Narrowest dimension of the wood rays is exposed and the rays show as narrow lines running longitudinally with the boards.
    - (3) *Comb-Grain* hardwood boards are cut halfway between the true plain sawed and true quarter sawed pieces to give a straight comb-grain effect.
  - (d) *Color*: The difference in color between heartwood and sapwood is more pronounced in some hardwoods than in others. For the effect desired the specification writer should designate *All Heartwood* or *All Sapwood* or else the lumber will be unselected for color.
  - (e) *Select*: The term "select" as often used in architectural specifications has caused confusion in many instances. The term "select" is a broad term designating a specific grade of lumber and it has no meaning insofar as color, figure or graining is concerned. If it is desired that raw material be selected to produce uniformity of color, figure or grain, the specifications should so state. Thus, in the absence of any specifications as to color, figure or grain, materials will be furnished "unselected" as to these characteristics.
- d. *Grade Marking* is stamping or branding on each piece or bundle the grade as determined by a recognized grader of the various associations to protect the consumer. This cannot be required for all of the millwork. If grade marking is desired, it should be called for under separate headings covering such items as siding, shingles, ceiling boards, etc.

- e. *Protective Treatment:* The Architectural Woodwork Institute recommends that a paragraph covering protective treatment for exterior woodwork be included as follows:

"All exterior material other than Tidewater Red Cypress, Clear Heart Redwood, and Pinas Strobas shall be protective treated with not less than 5% pentachlorophenol with a water repellent added for 3-min. dip."

### 18-3 INSTALLATION OF FINISH WOODWORK

There are certain general requirements for the installation of finish woodwork which should be mentioned within the specifications. Joints should be neatly matched and mitered. Exposed joints should be filled with thick white lead before jointing. Finish woodwork should be free from hammer marks. Finish woodwork should be sanded ready for finish. Splices should not be permitted in less than 12' for running trim. Exposed edges of trim should be coped. Finishing nails, unless otherwise specified, should be used for attaching the finish woodwork and nails should be countersunk.

### 18-4 WOOD SHINGLE SIDING AND ROOFING

- a. Wood shingles are thin pieces of lumber tapered lengthwise and are used as siding and roofing material. Many building codes will not allow wood shingles on roofs, but they permit their use as a siding material.
- b. *Location* of shingles for siding and roofing should show on the elevations on the drawings and need not be specified.
- c. *Grade:* The best grade specified for shingles is *No. 1 Grade 100% Edge Grain, 100% Clear and 100% Heartwood* complying with Commercial Standard CS31, latest edition. *No. 2* and other grades have not been adopted for uniform classification by the various shingle producing groups.
- d. *Material:* Wood shingles are made of Red Cedar, California Redwood and Southern Cypress. Red Cedar is the most prevalent.
- e. *Types and Sizes:* The two general types of wood shingles are Random Width Shingles and Dimension Shingles; i.e., of specified width. They are made in the following sizes:

Length	Thickness *	Width Random	Width Dimension
16	5/2	3" to 14"	5" and 6"
18	5/2 1/4	3" to 14"	5" and 6"
24	4/2	4" to 14"	6"

\* 5/2 means 5 butts in 2".

5/2 1/4 means 5 butts in 2 1/4".

4/2 means 4 butts in 2".

- f. Installation:* Shingles should be applied using only two hot-dipped zinc-coated (copper or aluminum) 3d shingle nails 1" above exposure for each shingle except that 5d nails shall be used at hips and ridges. Roof shingles are specified to be doubled at the eaves. Wood shingles should be overlapped and the approximate exposure to weather should be specified after selection from the following table:

<i>Exposure to Weather</i>	<i>16" Shingles One Bundle Will Cover</i>	<i>18" Shingles One Bundle Will Cover</i>	<i>24" Shingles One Bundle Will Cover</i>
5"	25.7 sq. ft. *		
5½"	28.3 sq. ft.	25.4 sq. ft. *	
6"	30.8 sq. ft.	27.8 sq. ft.	
7"	36.0 sq. ft.	32.4 sq. ft.	
7½"	38.5 sq. ft. **	34.7 sq. ft.	26.0 sq. ft. *
8"		37.0 sq. ft.	27.8 sq. ft.
8½"		39.3 sq. ft. **	29.5 sq. ft.
10"			34.7 sq. ft.
11"			38.2 sq. ft. **

\* Maximum roof exposure.

\*\* Maximum sidewall exposure.

- g. Shakes* are shingles produced by splitting wood blocks with hand tools. This produces a textured shingle as used in early colonial days. If shakes are specified, it would probably be best to give the name of the manufacturer.
- h. Staining:* It is sometimes specified that the shingles be dipped in stain either at the source of manufacture or at the job site before they are applied. This is considered good practice as both sides of shingle are coated; and although it uses more stain, labor costs are lower. If this method of staining is required it should be specified in this section and the brand name of the stain given.

#### 18-5 WOOD SIDING

- a.* Wood siding may be run to a special design prepared by the Architect or a standard type of wood siding could be used.
- b. Location* of the wood siding should not be specified but should be indicated on the elevations on the drawings.
- c. Type and Sizes:* The type of the wood siding may be specified to be a standard type such as "board" or "beveled" or "novelty" siding, or the siding may be of special design as shown on the drawings. Siding is usually run from 1" x 6", 1" x 8" and 1" x 10" stock. Mention should be made whether the siding is to be mitered at the corners or is to have special corner boards.

- d. *Installation:* The specification writer should note whether the siding is to be run vertically or horizontally and, unless a shiplap or T&G type of siding is used, the approximate exposure in inches should be given. Siding should be face-nailed to each stud with two 9d galvanized steel (copper or aluminum) casing nails.
- e. *Asbestos Cement Siding* is sometimes used instead of wood shingle or wood siding. Asbestos cement siding is best specified by calling for a specific brand and referring to or repeating the manufacturer's specifications.

## 18-6 EXTERIOR WOODWORK

- a. *Exterior Trim:* Any special requirements for the exterior trim should be noted by the specification writer and he probably should mention that all exterior mouldings shall be milled according to details and that brick moulds shall be applied around all door and window frames in masonry.
- b. *Wood Louvered Ventilators* are often installed in exterior walls to provide ventilation and to serve as exhaust panels for attic fans.
  - 1. *Location:* The louvered ventilators should show on the elevations of the drawings; therefore, the locations need not be specified.
  - 2. *Types and Sizes:* Architects have had trouble with louvered ventilators leaking when there is blowing rain and therefore the depth of the louvers should not be less than  $7\frac{1}{2}$ ". The louvers should be specified to be  $\frac{3}{4}$ " x  $7\frac{1}{2}$ " and the ventilators should be screened on the inside with 18 x 14 mesh bronze (aluminum or plastic) wire cloth to prevent insects from entering. Louvered ventilators should be equipped with a wood panel probably constructed of  $\frac{1}{4}$ " plywood for the purpose of closing the opening from the inside during winter months.
- c. *Eaves* (Figure 18-2) are often specified to be built up of material cut from 1" stock. To give ventilation, ventilators or a continuous open slot are specified to be installed in the soffit of the eaves and screened with 18 x 14 mesh bronze (aluminum or plastic) cloth.
- d. *Ceiling Boards*, 1" x 4", V'ed (or beaded), T&G, are often specified for porch ceilings and the soffit of projecting eaves.
- e. *Porch Screening:* The specification writer should mention that porches are to be screened and give the type of screening, which is usually 18 x 14 mesh antique bronze (aluminum or plastic) wire cloth. The screening should be pulled taut before fastening.
- f. *Special Mention* should be made of posts, porch railings, porch flooring, trellis work, wood fences and other special wood work if indicated on the drawings.

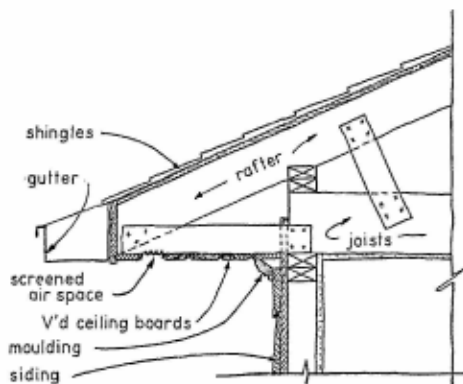


FIG. 18-2 EAVE DETAIL

### 18-7 WOOD WINDOWS

- a. Wood windows are often specified to be in full accordance with Commercial Standard CS163.
- b. *Window Frames* around wood double-hung windows and wood casements are made of wood also. The jamb and head pieces for double-hung windows may be specified to be wood from  $1\frac{1}{4}$ " stock (also from 1" stock) and for casements from  $1\frac{3}{4}$ " stock (also from  $1\frac{1}{2}$ " stock). Sills are specified to be cut from  $1\frac{3}{4}$ " stock (also  $1\frac{1}{2}$ " stock). Sills should be kerfed on the bottom to prevent warping.
- c. *Wood Sash* for double-hung windows and casement windows is used extensively in residential work.
  1. *Location:* Since all the elevations show the location of the wood sash, the specifications need not give the location.
  2. *Types and Sizes:* Wood sash is usually specified to be made of Ponderosa Pine. Sash should have mortise and tenon joints, and sash of double-hung windows should have check rails. Sash is usually specified to be  $1\frac{3}{8}$ " thick (also  $1\frac{1}{4}$ " thick when windows are over 5' 2" x 2' 8"; where insulating glass is used, it is specified to be 2" thick).
  3. *Double-hung Window Operation:* The specification writer should note what type of operation will be required of the double-hung windows. If weights and cords are used, the type of weights and brand of pulley and cord should be specified. To avoid having to fabricate weight boxes, the specification writer may call for balances (Pullman, Unique or other types) to be furnished and installed by the Contractor. Balances, weights, cords and pulleys are usually furnished by the Contractor and are not included in the hardware allowance.

- d. *Screens* are generally required for windows in residential work.
1. *Location:* The specifications should mention that all double-hung windows (except possibly the windows in the Garage) should be screened full height (or half height with sliding window screens). All casement windows should be screened on the inside.
  2. *Types and Sizes:* Frames for the screens are generally specified to be made of Ponderosa Pine  $1\frac{1}{8}$ " (or  $\frac{3}{4}$ ") thick and not less than  $1\frac{3}{4}$ " wide. Screen frames should have mortise and tenon joints.
  3. *Screen Fabric* should be 18 x 14 mesh antique bronze (aluminum or plastic) wire cloth set in grooves in the frame. Frames should be rabbeted and, after the screen fabric is installed, covered with a wood moulding.
  4. *Hangers and Fasteners* (or sliding tracks) for screens should be furnished and installed, as this type of hardware should not be in the hardware allowance.
- e. *Storm Sash:* When the weather conditions of the locality require it, storm sash should be specified for all windows (except possibly the windows of the Garage and Basement). These sash should be interchangeable with the window screens and should be equipped with hardware for fastening in place.
- f. *Prefabricated Wood Windows:* There are several manufacturers making prefabricated wood windows of the double-hung, casement, side-sliding and awning types. These windows are shipped as complete units, primed, glazed and equipped with weatherstripping and hardware. If required for the job, they should be specified by manufacturer's brand name.

#### 18-8 DOOR FRAMES

- a. Wood door frames are usually specified for all door openings in residential work.
- b. *Types and Sizes:* Interior door frames may be specified to be worked out of 1" stock (sometimes specified  $1\frac{1}{4}$ " stock) and shall have applied stops. Exterior door frames are usually specified to be worked out of  $1\frac{3}{4}$ " stock (sometimes specified 2" stock) and rabbeted for door and screen door.
- c. *Sills:* If metal thresholds are not to be used for exterior doors, then the specification writer should probably specify sills for exterior doors to be made of Oak from 2" stock.

#### 18-9 WOOD DOORS

- a. Specification paragraphs covering wood doors are simplified if the drawings include a door schedule similar to Figure 2-2.



- b. *Location* of all doors should clearly show on the plans and the door schedule and need not be mentioned in the specifications.
- c. *Types*: The three main types of stock doors are as follow:
  - 1. *Panel Type Doors* are doors made with solid wood stiles and rails with raised wood panels or with flat plywood panels.
  - 2. *Flush Doors* are doors made of wood veneers over solid wood, mineral or grid type cores.
  - 3. *Panel Type Doors with Veneered Stiles and Rails*: This type seldom used in residential work is being supplanted by flush doors in commercial work.
- d. *Sizes* of wood doors should be indicated on the door schedule of the drawings. The stock sizes of doors are as follows:
  - 1. *Stock Thicknesses*:  $\frac{3}{4}$ ",  $1\frac{1}{8}$ ",  $1\frac{3}{8}$ ", and  $1\frac{3}{4}$ ". The  $\frac{3}{4}$ " is generally used for cabinet doors.  $1\frac{1}{8}$ " for screened doors,  $1\frac{3}{8}$ " for interior doors and  $1\frac{3}{4}$ " for exterior doors.
  - 2. *Stock Widths*: Usually 1' 6", 2' 0", 2' 4", 2' 6", 2' 8" and 3' 0". Usually Bathroom doors are 2' 4", Bedroom doors are 2' 8" and exterior doors are 3' 0".
  - 3. *Stock Heights*: Usually 6' 6", 6' 8", 6' 10" and 7' 0". The 6' 8" height is probably the most popular height for interior work in residences and often the exterior doors are 7' 0" high.
- e. Designs of doors are usually indicated on the drawings in connection with the door schedule.

#### 18-10 PANEL TYPE DOORS WITH SOLID STILES AND RAILS

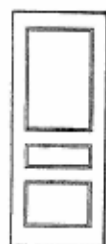
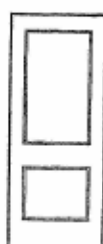
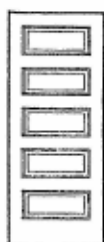
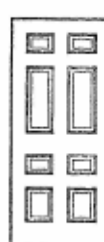
(See Figure 18-3)

- a. Panel type doors with solid stiles and rails are usually made of Ponderosa Pine or Douglas Fir and have flat panels, raised panels or glazed panels.
- b. *Ponderosa Pine Doors* should be furnished where the door schedule on the drawings call for wood doors. These doors should conform to Commercial Standard CS120, latest edition.

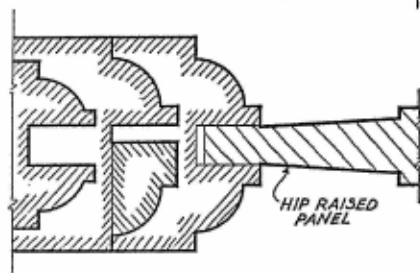
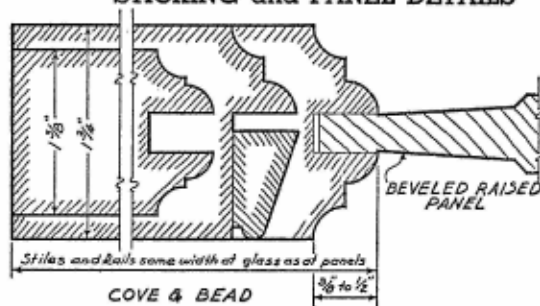
*Grades*: The specifications might require the doors to be grade marked. The specifications should stipulate one or more of the following grades:

  - Grade No. 1*: Suitable for natural, stained or paint finish.
  - Grade No. 1F*: Same as No. 1 except panels may be of Fir plywood.
  - Grade No. 2*: Suitable for paint finish.
  - Mill Run Grade*: Suitable for paint finish; only used in garage doors.
- c. *Douglas Fir Doors* (Sitka Spruce or Western Hemlock Doors) should be furnished where the door schedule on the drawings calls for "Fir"

## POPULAR PATTERNS OF INTERIOR DOORS

N.D. 99  
THREE PANELN.D. 100  
ONE PANELN.D. 101  
INNER FRAMEN.D. 102  
TWO PANELN.D. 105  
FOUR PANELN.D. 107  
FIVE CROSS PANELN.D. 108  
SIX PANEL COLONIALN.D. 111  
EIGHT PANEL COLONIAL

## STICKING and PANEL DETAILS



OVOLO

FIG. 18-3 TYPICAL PANEL TYPE DOORS AND STICKING (Courtesy of Nat'l Woodwork Mfgs Assoc.)

("Spruce" or "Hemlock") doors. These doors should meet the requirements of Commercial Standard CS73, latest edition.

*Grades:* The specification might require the doors to be grade marked. The specifications should designate one or more of the following grades:

*Grade A:* Recommended for paint, natural or stain finish.

*Grade B:* Recommended primarily for paint finish.

*Grade C:* Recommended for paint finish and permits more defects than Grade B.

*Mill Run:* This grade only in  $1\frac{1}{8}$ " thickness made by planing down stock too thin for  $1\frac{3}{8}$ ".

- d. *Sticking:* If a particular type of sticking (mouldings worked into rails and stile) is desired for stock doors, it should be mentioned selected from Figure 18-3. The *Cove and Bead* and *Ovolo* are the most popular types of sticking used.

#### 18-11 FLUSH DOORS (See Figure 18-4)

- a. Flush doors are made in several price ranges, depending upon the type of core, edge strips and veneers. Doors with hollow core without hardwood edge strips and with face veneers suitable only for painting are the cheapest; and doors with solid core with hardwood strips matching the face veneers suitable for natural or stain finish are the most expensive. Mineral core doors and Institutional type doors fall between the price range of hollow and solid core doors. Solid core doors are generally used for commercial work and for exterior doors of residential work. Solid core doors naturally resist passage of fire more than the hollow core doors.
- b. *Cores:* Type of core for the flush wood doors should be specified.
1. *Hollow Core* consists of interlocking horizontal and vertical wood or fiber-board strips forming a grid or of strips of veneer, spot glued at intervals and stretched within the rails or of filler strips of inert material.
  2. *Mineral Core* (not illustrated) consists of a mineral composition with suitable strength and resistance to decay and fire.
  3. *Institutional Doors* are similar to hollow core doors except the stiles and rails are wider and there is a center rail.
  4. *Solid Core* made of low-density wood blocks in narrow strips laid up with the grain running vertically or horizontally.
- c. *Stiles and Rails* are generally specified to be made of softwood.
1. *Stiles:* Width is specified to be not less than  $1\frac{1}{8}$ " ( $1\frac{1}{4}$ ") except for institutional door where the combined stile width should not be less than  $5\frac{3}{4}$ ".

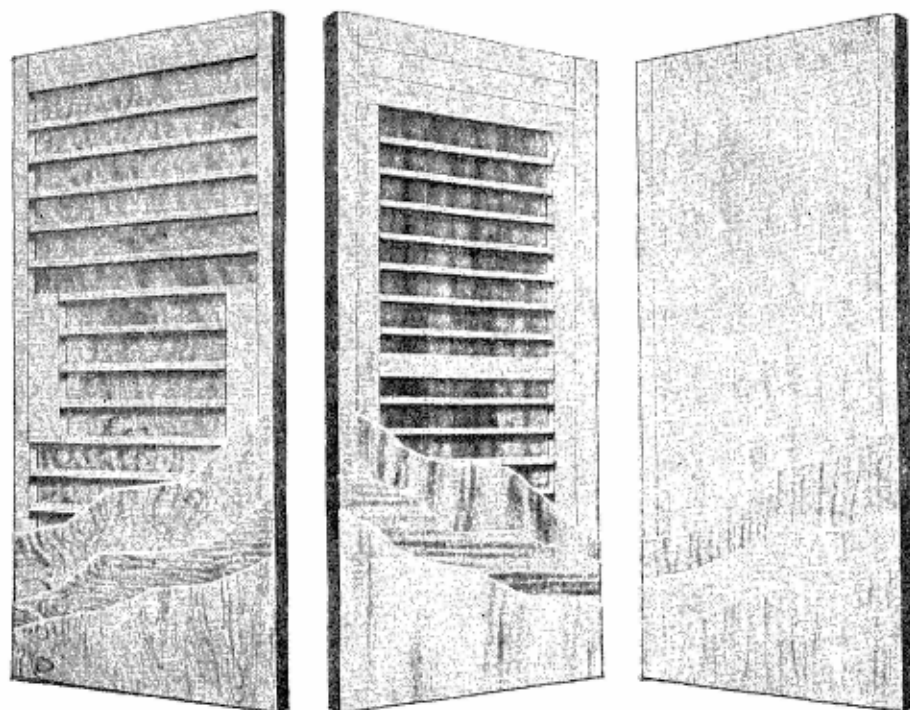


FIG. 18-4 FLUSH DOORS. READING FROM LEFT: HOLLOW CORE, INSTITUTIONAL, AND SOLID CORE. SOURCE: CATALOG OF CADDO DOOR AND VENEER CO., SHREVEPORT, LA.

2. *Rails:* Width is specified to be not less than  $2\frac{1}{2}$ " (or  $2\frac{3}{4}$ ") except for institutional doors where the combined width of top rail and bottom rail should not be less than 9" each and a center rail not less than 3" wide.
- d. *Edge Strips:* On better type doors the specifications call for the stiles to match face veneer or for edge strips, not less than  $\frac{1}{2}$ " ( $\frac{3}{4}$ ") wide matching face veneers, to be provided.
- e. *Lock Blocks* are specified for doors with hollow core or mineral type core. These should be at least 20" (or 27") not less than 4" ( $4\frac{5}{8}$ ") from outer edge of door. Lock block should be specified to be on one side of door or on both sides of door.
- f. *Crossbanding* should be required under all face veneers except where face veneers are  $\frac{1}{4}$ " thick on solid core doors. The thickness of crossbanding and face veneer should be not less than  $\frac{1}{8}$ ".
- g. *Face Veneers* are usually specified to be  $\frac{1}{28}$ ",  $\frac{1}{20}$ " or  $\frac{1}{16}$ " thick, although  $\frac{1}{8}$ " is often specified for interior doors of commercial work and  $\frac{1}{4}$ " for exterior doors. The type of cut of face veneers should

be specified the same as discussed under paragraphs entitled *Hardwood Plywood* and *Douglas Fir Plywood*.

- h. *Grades* of flush doors are as follows according to Commercial Standard CS-171:

- Premium Grade
- Good Grade
- Sound Grade
- Plastic Grade
- Hardboard Grade

- i. *Types* of flush doors are:

- Type I*—fully waterproof bond
- Type II*—water-resistant bond

#### 18-12 SCREEN DOORS

- a. *Location*: Screen doors are often specified for all openings into screened porches and for all exterior door openings except for door openings into Garage and Basement.
- b. *Type and Size*: Screen door frames are specified to be made of Ponderosa Pine  $1\frac{1}{8}$ " (or  $1\frac{3}{8}$ ") thick with stiles not less than  $4\frac{3}{4}$ " wide. Screen door frames should have mortise and tenon joints.
- c. *Screen Cloth* should be 14 x 18 mesh antique bronze (aluminum or plastic) wire fabric, set in grooves in the frame. Frame should be rabbeted and, after screen fabric is installed, covered with wood moulding.
- d. *Screen Door Grille* should be specified for the bottom panel of all screen doors to protect the finer screen cloth. Bronze cloth of 4 mesh (or 2 mesh) 0.063 wire (or 4 x 4 mesh hardware cloth complying with CS-132) is specified for this purpose.

#### 18-13 GARAGE DOORS

Overhead type garage doors, often used in residential work, should be specified by the manufacturer's brand name. Mention should be made that the doors shall be complete with all necessary hardware including bolts, springs, trolleys, tracks, cylinder locks and keys. Thickness of the doors should be  $1\frac{3}{8}$ " (or  $1\frac{3}{4}$ "). The panels are often specified to be of flat laminated wood and the stiles and rails of wood mortised, tenoned, glued and steel-doweled together.

#### 18-14 INTERIOR WOODWORK

- a. *Trim*: Door and window casing is sometimes specified to be moulded strictly according to details (or stock moulded casing) and mitered at all corners. Door casing should be provided with plinths, except trim in Closets, Basement Rooms and Utility Room which shall be plain  $\frac{3}{4}$ "

x 3½" without plinths. Other types of trim such as baseboards, chair rails and cornice should be mentioned.

- b. *Paneling*: The two most common types of wood paneling used are plank paneling and plywood paneling. Typical paragraphs covering their use might read as follows:

1. "*Plank Paneling* shall be installed on walls in all areas where called for in the Finish Schedule. Plank paneling shall be cut from 1" stock of random widths and shall have shiplapped (T&G) moulded joists as detailed. Plank paneling shall be installed horizontally (or vertically with 2 x 4 blocking provided 24" o.c.). The inside surface of exterior wall studs shall be covered with 15 lb. asphalt saturated felt before paneling is applied."

2. "*Plywood Paneling* shall be installed on walls in areas where called for in Finish Schedule. Plywood paneling shall be ¼" thick and installed with butt (or open) joints with grain running vertically. Studs shall be stripped with ½" thick plywood strips and the inside surface of exterior wall studs shall be covered with ½" fiber-board before paneling is applied."

- c. *Cedar Lining*: In residential work certain closets used for storing woolen articles are often lined with Red Cedar for its aromatic effect.

1. *Location*: The specification writer might state that the entire inside surfaces of closets noted to have Cedar lining on the *Finish Schedule* shall be covered with Cedar lining including the inside surface of the door.

2. *Types and Sizes*: The T&G aromatic Red Cedar generally used for closets is ¾" thick with a 2" face (1⅜" thick with 2¼" face).

3. *Installation*: To prevent the loss of aroma from the back side of the lining, the specification writer may include the provision that the closet be lined with wallboard or felt before the Red Cedar lining is applied. The specification writer should designate whether this is to be installed vertically or horizontally.

- d. *Grille*: Wood grilles are sometimes specified for the ceiling opening for attic fan. Grille of this type is sometimes made of ¼" x 1¼" strips 3" o.c. with half lap joints. It is also specified to be equipped with hinged grille cover to close opening in winter when fan is not in use. Grille size and location should be indicated on the drawing.

- e. *Shelves*: The specifications for a residence should require shelves to be furnished for all closets and book cases. Two shelves are usually specified for coat closets and clothes closets and five shelves for pantry and linen closet. The shelves for book cases are usually specified to be adjustable and equipped with flush metal standards and metal supports.

Shelves are usually made from 1" stock material and shelves in closets are often supported on 1" x 4" cleats. If shelves are specified to be made of plywood, edge bands of same material as face veneer should be used.

- f. *Wood Flooring*: Mention should be made that interior wood flooring is specified in *Flooring* section of the specifications.

#### 18-15 PLYWOOD

- a. Plywood is a large thin board made up of several layers or "plies" of thin wood veneers glued together. With the recent development in adhesives, plywood has become a more important building material. The two most common types of plywood are Douglas Fir and Hardwood Plywood.
- b. *Douglas Fir Plywood*: Specification paragraph covering Douglas Fir Plywood should designate where it is to be used and give the type, grade and thickness.
1. *Use*: Douglas Fir Plywood is usually less expensive than the hardwood plywoods and is often specified for plywood work not exposed to view. It is also specified for plywood work exposed to view and to be painted, stained or given a natural finish; but, it should be remembered that it is more difficult to get as smooth a paint finish on fir plywood as on hardwood plywood and the graining often is not as pleasing for stained or natural finish as many of the hardwoods.
  2. *Type*: Douglas Fir Plywood is most easily specified by reference to Commercial Standard CS45, latest edition, and the grading rules of the Douglas Fir Plywood Association, Tacoma, Washington. There are two types of Douglas Fir Plywood:
    - (a) *Interior Type*: This represents the majority of production and is specified for interior work where the ultimate in moisture resistance is not required.
    - (b) *Exterior Type*: This type represents the maximum in moisture resistance and is specified for exterior work or for locations where moisture is prevalent.
  3. *Exterior Grades*: There are six exterior grades established by the Douglas Fir Plywood Association as follows:
    - (a) *EXT-DFPA A-A*: For permanent outdoor uses where appearance of both sides is important: Outdoor furniture, certain fences and enclosures, signs, marine uses.
    - (b) *EXT-DFPA A-B*: Uses similar to exterior A-A panels but where appearance of one side less important. Alternate for EXT-DFPA A-A.

- (c) *EXT-DFPA A-C*: Used for soffits, breezeways, gable ends. The versatile "one side" grade of Exterior plywood with waterproof bond.
  - (d) *EXT-DFPAB-C*: A utility outdoor panel for farm buildings particularly.
  - (e) *EXT-DFPA C-C*: Unsanded grade with waterproof bond. Backing or rough construction. Usually specified in *Rough Carpentry* section.
  - (f) *EXT-DFPA PLYFORM*: This is the grade of plywood specified when panels with waterproof bond are desired so concrete forms may be reused until wood is literally worn away. Usually specified in *Concrete* section.
  - (g) *EXT-DFPA-C REP C*: This grade is used as a base for tile, linoleum and carpeting where unusual moisture conditions exist.
4. *Interior Grades*: There are six interior grades established by the Douglas Fir Plywood Association as follows:
- (a) *INT-DFPA A-A*: For all interior applications where both sides to be in view. Cabinet doors, built-ins, furniture, displays, booth partitions.
  - (b) *INT-DFPA A-B*: For all inside uses requiring one surface of highest appearance and opposite side solid and smooth. Alternate for A-A.
  - (c) *INT-DFPA A-D*: The many-purpose, "one side" material for interior uses. Wall and ceiling paneling, built-ins, wainscoting, backing and underlayment, counters, fixtures, displays, cut-outs.
  - (d) *INT-DFPA B-D*: A base and backing material for interior use. Face also is solid, paintable.
  - (e) *PLYSCORD*: The unsanded sheathing or structural grade of fir plywood. Wall and roof sheathing, subflooring. Temporary enclosures, backing. Usually specified in *Rough Carpentry* section.
  - (f) *B-B PLYFORM*: The reusable concrete form plywood for ease of form construction, smooth concrete surfaces. Glue bond is highly moisture resistant but NOT waterproof. Usually specified in *Concrete* section.
  - (g) *Other Interior Grades* include *INT-DFPA B-B*, a utility panel used where two smooth sides are required; *DFPA 2-4-I*, new combination subfloor and underlayment made in  $1\frac{1}{8}$ " thickness only, serves as a base for tile, linoleum, carpeting and wood strip flooring and is used on 4' 0" spans; *INT-DFPA N-N* and *INT-DFPA N-D* are made on special order, "N" designates natural finish veneer, select, all heartwood and free of open defects.



TABLE 18-8. DOUGLAS FIR PLYWOOD  
GRADES OF EXTERIOR-TYPE\*

Grade-Trademark	Face	Back	Widths [Feet]	Lengths [Feet]	Thicknesses [Inches]
EXT-DFPA · A-A	A	A	4	8	$\frac{3}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , 1
EXT-DFPA · A-B	A	B	4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , 1
EXT-DFPA · C-C	A	C	4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$ , 1
EXT-DFPA · B-C	B	C	4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$
EXT-DFPA · C-C	C	C	4	8	$\frac{5}{16}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$
EXT-DFPA · PLYFORM	B	B	4	8	$\frac{3}{4}$ , 1

GRADES OF INTERIOR-TYPE\*

Grade-Trademark	Face	Back	Widths [Feet]	Lengths [Feet]	Thicknesses [Inches]
INT-DFPA · A-A	A	A	3, 4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$
INT-DFPA · A-B	A	B	3, 4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$
INT-DFPA · A-D	A	D	3, 4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$
INT-DFPA · B-D	B	D	4	8	$\frac{1}{4}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$
PLYSCORD	C	D	4	8	$\frac{5}{16}$ , $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{8}$ , 1
B-B · PLYFORM	B	B	4	8	$\frac{3}{4}$ , 1

\* All grades are sanded both sides except EXT-DFPA · C-C and Interior PLYSCORD, which are unsanded. Panels  $\frac{5}{8}$ " and thinner have a minimum of three plies:  $\frac{1}{2}$ " to  $\frac{5}{8}$ " incl. are 3-ply minimum; thicker are 7-ply minimum. If more plies per thickness are desired they may be had on special order. Also available are king size panels 12', 14', 16', 20' and longer.

5. *Sizes:* (Table 18-8 shows sizes of panels and thicknesses of Douglas Fir Plywood.) The thicknesses used are as follows:

<i>For</i>	<i>Spacing of Supports</i>	<i>Thickness</i>
Siding	Studs 16" o.c.	$\frac{3}{8}"$
Wall Sheathing	Studs 16" o.c.	$\frac{5}{16}"$
Wall Sheathing	Studs 24" o.c.	$\frac{3}{8}" - \frac{1}{2}"$
Roof Sheathing	Rafters 16" o.c.	$\frac{5}{16}"$
Roof Sheathing	Rafters 24" o.c.	$\frac{1}{2}"$
Roof Sheathing	Rafters 32" o.c.	$\frac{3}{4}"$
Subflooring	Joists 16" o.c.	$\frac{1}{2}"$
Subflooring	Joists 24" o.c.	$\frac{3}{4}"$
Interior Finish	Studs 16" o.c.	$\frac{1}{4}"$
Interior Finish	Studs 24" o.c.	$\frac{3}{8}"$
Underlayment		$\frac{1}{4}"$

- c. *Western Softwood Plywood* is also manufactured and serves the same purposes of Douglas Fir Plywood. It may be specified by reference to Commercial Standard CS122. This plywood is made out of a variety of softwoods including larch, fir, Sitka spruce, cedar, redwood, white pine, and Western poplar. The plywood is graded under the rules of the Douglas Fir Plywood Association, which rules are similar to those for fir except with *WSP-* added at the beginning of the grade designation.
- d. *Hardwood Plywood* is most easily specified by reference to Commercial Standard CS35, latest edition and the Standards of the Hardwood Plywood Institute. Specification paragraphs covering hardwood plywood should designate where it is to be used and give the type of core, type of bond, type of face veneer, the grade and thickness.
1. *Use:* Hardwood plywood is often specified for plywood work exposed to view and given a stained, natural or paint finish.
  2. *Types of Core* (Figure 18-5) are as follows:
    - (a) *Veneer Core Construction* is preferred for Type I plywood, for bending and molding exterior purposes or where subjected to moisture. The number of plies required depends on how panel will be used—as a general rule the more plies, the more stable the panel will be and the more uniform its strength over larger areas.
    - (b) *Lumber Core Construction* is generally used for furniture, built-ins, fixtures, and when edge treatment of wood is desired or where butt hinges are to be used. The lumber core is made of narrow solid wood strips (arranged to equalize stress) and edge-glued together. Lumber core panels with face wood banded on

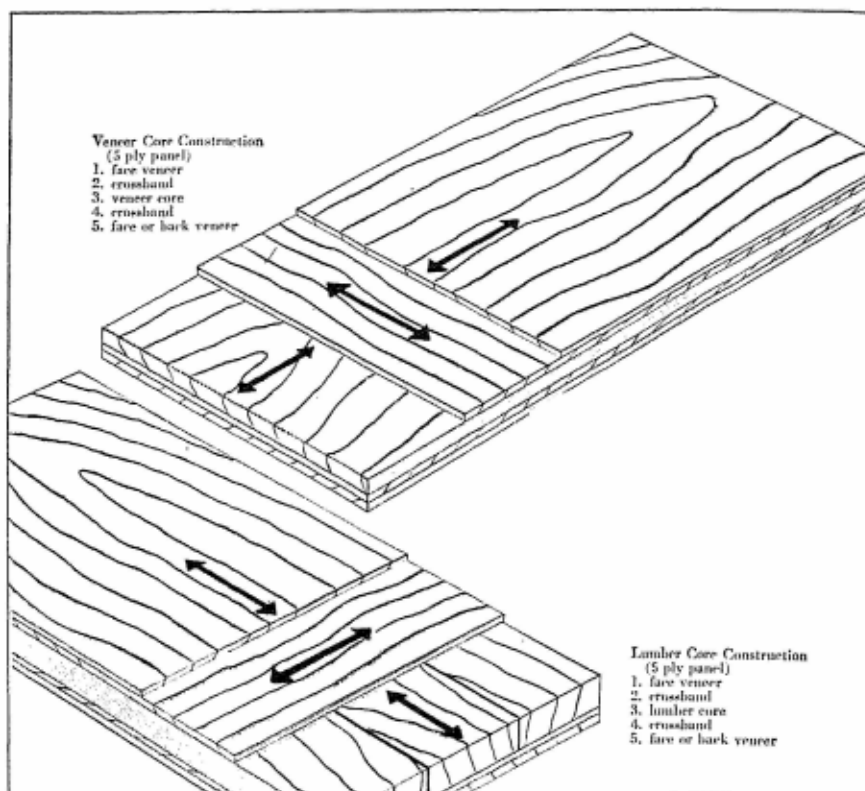


FIG. 18-5 TYPES OF CORES OF HARDWOOD PLYWOOD. SOURCE: "A TREASURY OF HARDWOOD PLYWOOD" PUBLISHED BY THE HARDWOOD PLYWOOD INSTITUTE

sides and ends may be special ordered. This core is for interiors and is made in Types II and III only.

### 3. Type of Bond:

*Type I:* Fully waterproof bond, usually specified for exterior.

*Type II:* Highwater resistant bond, usually specified for interior.

*Type III:* Low water resistant bond.

4. *Types of Face Veneer* (Figure 18-6) should be specified after examination of samples to determine the color and graining desired. Rotary cutting is accomplished by rotating a log against a knife; this is quickest and most economical method of securing face veneers but results in a *wild* figure of grain. Half round cutting is accomplished by rotating a portion of a log off center against a knife; this results in grain figure more nearly approximating plain sliced or quarter sliced than

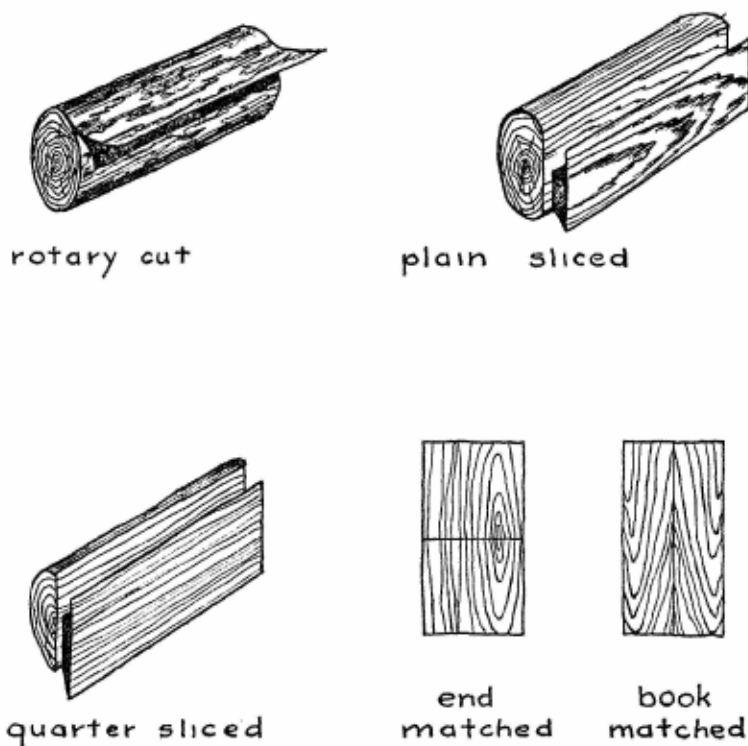


FIG. 18-6 TYPES OF FACE VENEER OF HARDWOOD PLYWOOD

the rotary cut pieces. Plain sliced (or sawed) are the pieces obtained by slicing (or sawing) through the log lengthwise; the outer pieces result in a flat grain while the center slices show edge grain (counted as quarter sliced pieces). Slices opened like a book as they are made and the grain thus matched are referred to as *book matched*. If the slices are opened on end and the grain thus matched at the ends, it is referred to as *end matched*.

Most popular method of cutting is rotary; most popular species are Red Gum, Maple, Birch, Mahogany, Walnut and Cherry.

5. *Grades of hardwood plywood refer to the face veneer:*

*Custom Grade:* Panels of grade description agreed upon by buyer and seller for special uses.

*Grade 1 (Good):* Each face matched for color and grain and sound, smooth surface.

*Grade 2 (Sound):* Not matched for color and grain but has sound, smooth surface.

*Grade 3 (Utility):* Not matched for color and grain; defects permitted.

*Grade 4 (Reject):* More defects than in "Grade 3" permitted.

6. *Sizes:* Standard sizes and thicknesses of finished hardwood plywood are as follows:

(a) *Widths:* 24", 28", 30", 36", 42", 48". (Tolerance plus or minus  $\frac{1}{32}$ ".)

(b) *Lengths:* 72", 84", 96", 120", and 144" and up to 192" on order. (Tolerance plus or minus  $\frac{1}{32}$ ".)

(c) *Thicknesses:*  $\frac{1}{8}$ ",  $\frac{3}{16}$ ",  $\frac{1}{4}$ ",  $\frac{5}{16}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ". (Tolerance: sanded panels plus 0" minus  $\frac{1}{32}$ ".) The most common thicknesses of the above are  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ", and  $\frac{3}{4}$ " (veneer construction) and  $\frac{1}{2}$ ",  $\frac{5}{8}$ " and  $\frac{3}{4}$ " (lumber core construction).

7. *Prefinished:* Many manufacturers of hardwood plywood are furnishing the panels prefinished, if so specified.

## 18-16 WALLBOARDS

- a. In addition to plywood there are other boards used extensively in residential work and the proper place to specify them is in the *Finish Carpentry* section of the specifications. It is best to specify them by brand name and give the manufacturer's specification for installation. These boards include:
- b. *Cement Asbestos Board*,  $\frac{1}{8}$ " and  $\frac{3}{16}$ " thick used where board with fire resistance is desired. Cement asbestos boards with insulation sandwiched in between are used for structural systems of walls and partitions.
- c. *Fiber-board* of the hard-pressed type  $\frac{1}{10}$ ",  $\frac{1}{8}$ ",  $\frac{3}{16}$ ",  $\frac{1}{4}$ " and  $\frac{5}{16}$ " thick is used for finished and wearing surfaces while loosely pressed boards  $\frac{1}{2}$ " and 1" thick are used for thermal insulation and for finish surfaces where sound absorption qualities are desired.

## 18-17 WOOD STAIRS

In residential work there are three types of stairs specified: the main stair where the best type of workmanship may be required, the service stair where the fine workmanship is not important, and disappearing stair used to give easy access to attic storage space without the expense of a fixed stair. Paragraphs covering these three types are often written as follows:

1. "*Main Stair* shall be constructed of  $\frac{3}{4}$ " risers and  $1\frac{1}{16}$ " treads meeting the requirements of Commercial Standard C589. Risers and treads shall

be tongued and grooved together and housed into stringers. Treads shall be of Oak to match flooring and shall have rounded nosing. Railings, newels and balusters shall be as detailed and the railings shall be of select Oak, Birch or Maple."

2. "Service Stair need not be tongued, grooved and housed and shall be constructed of  $\frac{3}{4}$ " risers and  $1\frac{1}{16}$ " treads. Rails shall be constructed of 2 x 4's."
3. "Disappearing Stair to attic space shall be Model No. \_\_\_\_\_ complete with all operating hardware as manufactured by \_\_\_\_\_. Stair shall be 2' 6" wide and of proper length to fit the condition. Install where indicated on drawings."

#### 18-18 FIREPLACE MANTELS

If fireplace mantels are to be stock items, the *Finish Carpentry* section should include a paragraph reading as follows:

"Install stock wood mantels and allow the sum of \$\_\_\_\_\_ for their purchase."

#### 18-19 KITCHEN CABINETS

Unless unusual kitchen cabinets are wanted by the Owner, it is economical to purchase prefabricated cabinets and the *Finish Carpentry* section should include a paragraph reading as follows:

"Install prefabricated wood (or metal) kitchen cabinets including counters and allow the sum of \$\_\_\_\_\_ for their purchase."

#### 18-20 FINISH HARDWARE

Finish hardware, such as door butts, door stops and closers, lock sets, latch sets, window pulls and locks, is generally purchased under an allowance on small buildings. The *Finish Carpentry* section should include a paragraph reading as follows:

"Install all finish hardware and allow the sum of \$\_\_\_\_\_ for purchase of finish hardware not otherwise called for."

#### 18-21 GLASS AND GLAZING

Mention might be made that glass and glazing are specified in the section entitled *Weatherstripping, Insulation, Caulking and Glazing*.

#### 18-22 BACK PAINTING AND PRIMING

Although not often done on residential work, it is best to specify that before it is installed all millwork be given a prime coat of lead and oil paint on the

surfaces which will not be exposed in the completed work. Some architects specify that all painted woodwork is to be given a priming coat of lead and oil paint before shipment, except the millwork which is to be stained, to which a prime coat shall be applied on the back and unexposed surfaces only.

## CHAPTER 19

# Roofing and Sheet Metal

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### 19-1 GENERAL

- a. The principal types of roofing used for residential work include roll roofing, wood shingles, asphalt shingles, asbestos shingles, tile roofing, slate roofing, built-up roofing and metal roofing.
- b. *Preparation for Roofing:* To be sure the Roofing Contractor will be responsible for his work, the specification should stipulate that he shall see that roof surfaces are smooth, firm, dry and free from loose material and that all vent lines extending through the roof are properly flashed and secured in position before beginning his work.
- c. *Shop Drawings:* If the sheet metal work happens to include special formed shapes, the Contractor should be required to submit shop drawings.
- d. *Felt:* Asphalt-saturated felt is installed under all roofs and the application is often specified in the *Rough Carpentry* section to enable the General Contractor to get his building "in-the-dry" immediately without waiting for his Roofing Subcontractor to act. This asphalt-saturated felt should be 15 lb. under roll roofing, built-up roofing, asphalt shingles and metal roofing, and 30 lb. under asbestos shingles, tile roofing and slate roofing.

### 19-2 ROLL ROOFING

- a. Roll roofing consists of rolls of asphalt-impregnated felt surfaced with colored mineral particles. The portion of the roll roofing to be concealed after laying is called the "Selvage" edge. Roll roofing is the least expensive type of roofing discussed in this chapter.
- b. *Use:* Roll roofing is used on barns and similar structures when economy is the main factor and on low-pitched roofs of residences. Roll roofing is used on pitched roofs only and it is recommended by the manufacturers that the pitch of roofs be not less than the following:



1. With 2" lap—3 to 12 pitch.
2. With 3" lap—2 to 12 pitch.
3. With 19" lap—1 to 12 pitch.
- c. *Type and Size:* Mineral-surfaced roll roofing may be specified by manufacturer's brand name or by requiring it to conform to Fed. Spec. SS-R-521, Type I, 36" wide, 19" selvage edge, weighing not less than 55 lbs. per 108 sq. ft. (or 2" or 3" selvage edge, weighing not less than 90 lbs. per 108 sq. ft.). Color should be selected by the Architect.
- d. *Application:* Roll roofing should be applied parallel to the eaves lapping the edges of adjacent bands 19" (2" or 3") and the ends 8" (or 6") and securing with galvanized roofing nails of size to penetrate roof sheathing  $\frac{3}{4}$ ", nails spaced 12" o.c. (2" to 3" o.c. for 2" or 3" lapped edges). Hot asphalt or cold cement should be used in full accordance with the manufacturer's direction sheets.

### 19-3 ASPHALT SHINGLES (Figure 19-1)

- a. Asphalt shingles are composed of the same material as roll roofing and are made in strips and individual shingles.
- b. *Use:* Because of their economy and fire resistance, asphalt shingles are used extensively on pitched roofs of residences, provided the pitch of the roofs is not less than 4 to 12 (5 to 12 for types not giving complete double coverage such as hexagon strip shingles or individual shingles laid in interlocked or dutch lap method).
- c. *Types and Sizes:* Mineral-surfaced shingles may be specified by manufacturer's brand name or by requiring them to meet the requirements of Fed. Spec. SS-R-521, Type II, Underwriters' Class C Label, of color to be selected by the Architect, and by calling for specific type. Popular types include:
  1. *Strip Shingles*, three tabs 12" x 36", weighing not less than 250 lbs. per square.
  2. *Strip Shingles*, three tabs, 12" x 36" weighing not less than 210 lbs. per square.
  3. *Double Coverage Lock-Down Shingles*, 20" x 18½" weighing not less than 230 lbs. per square.
  4. *Individual Shingles for American Method Installation*, 16" x 12", weighing not less than 320 lbs. per square.
  5. *Individual Shingles for Dutch Lap Installation*, 12" x 16", weighing not less than 162 lbs. per square.
  6. *Hexagon Strip Shingles*, two tabs (or 3 tabs) 11½" x 36", weighing not less than 167 lbs. per square.

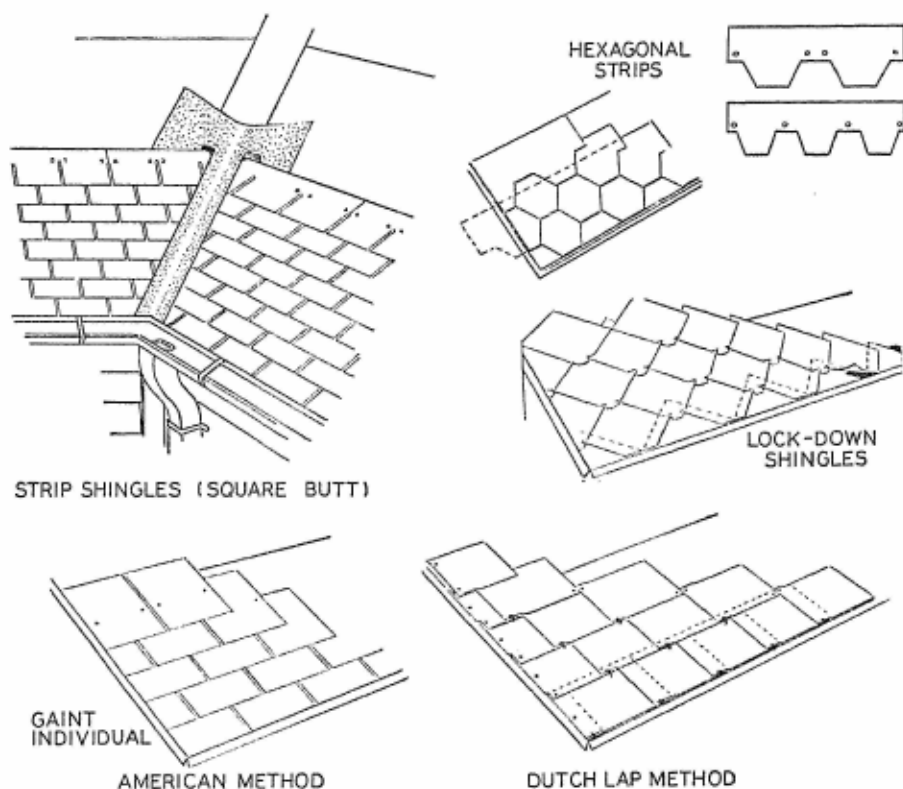


FIG. 19-1 ASPHALT SHINGLES (Courtesy Asphalt Roofing Industry Bureau)

It should also be mentioned that special shingles shall be furnished for hips and ridges, and sheets for flashing; special shingles and sheets should be surfaced to match.

- d. *Application:* Asphalt shingles are usually specified to be laid in full accordance with manufacturer's direction sheets using galvanized roofing nails of proper size to penetrate the roof sheathing  $\frac{3}{4}$ " and roofing cement as recommended by the manufacturer of the shingles.
- e. *Base Flashing* should be installed where vertical surfaces come against roof surfaces. Base flashing should be mineral surfaced roll roofing and should extend up vertical surfaces not less than 6" and out on roof surfaces not less than 4".
- f. *Valley Flashing:* Valleys should be flashed with two thicknesses of mineral surfaced roofing, one 9" wide and the other 18" wide. Valley flashing should be applied before shingles are laid.

#### 19-4 WOOD SHINGLES

Wood shingles are permitted to be used as a roofing material in some localities. The specification for wood shingles is described in Paragraph 18-4 of the chapter entitled "Finish Carpentry." The base and valley flashing for wood shingles would be similar to the flashing described for asbestos shingles in this chapter.

#### 19-5 ASBESTOS SHINGLES (See Figure 19-2)

- a. Asbestos shingles are made of portland cement and asbestos fibers pressed into sheets making a good fire-resistive covering for pitched roofs.
- b. *Use:* Asbestos shingles are used for pitched roof surfaces when the Owners can afford a material better than asphalt shingles.
- c. *Types and Sizes:* Asbestos shingles may be specified by trade name or by requiring them to meet the requirements of Fed. Spec. SS-S-291c with the additional requirement that color and texture will be selected by the Architect and that they be one of the following:

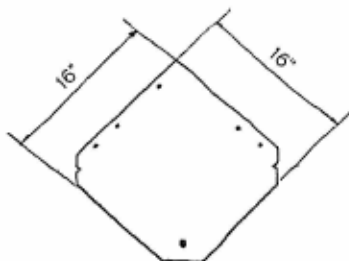
- 1. *Hexagonal Shingles* 16" x 16" x  $\frac{5}{32}$ " thick.
- 2. *Dutch Lap Shingles* 16" x 16" x  $\frac{5}{32}$ " thick.
- 3. *American Colonial Method Shingles* 14" x 30" x  $\frac{5}{32}$ " thick.
- 4. *Single-Unit American Method Shingles* 16" x 8" x  $\frac{1}{4}$ " thick.

It should also be mentioned that special shingles shall be furnished for hips and ridges and as starters.

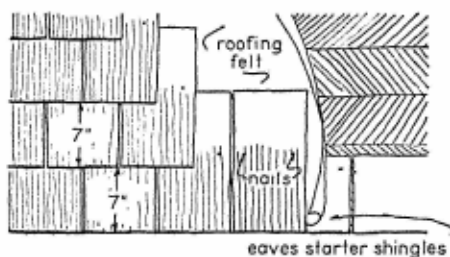
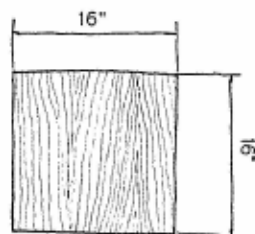
- d. *Application:* Asbestos shingles should be specified to be laid in full accordance with manufacturer's direction sheets using copper nails of proper size to penetrate the roof sheathing  $\frac{3}{4}$ " and roofing cement as recommended by the manufacturer of the shingles.
- e. *Open Valleys* are often specified to be open 4" wide. Valleys should be flashed with 16-oz. copper sheets not over 8' 0" long, lapping joints 6" and extending under shingles at least 6" on each side. Copper should be fastened with copper cleats 24" o.c.
- f. *Closed Valleys* (Alternate for e above): In these valleys the shingles are cut to fit the valley troughs. Each course of shingles should be flashed separately with 16-oz. copper sheets laid just above the butt line of each succeeding course and carried at least 6" (or 8") onto each slope.
- g. *Base Flashings* should be installed where vertical surfaces come against roof surfaces. Base flashing should be of 16-oz. copper sheets laid just above the butt line of each succeeding course and carried on to the roof at least 6" and up vertical surfaces at least 5".



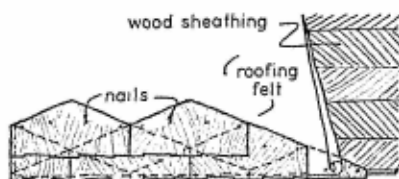
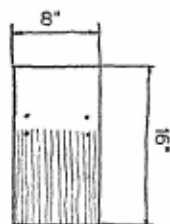
Hexagonal



Dutch Lap



American Method



American Colonial Method



FIG. 19-2 ASBESTOS SHINGLES

## 19-6 SLATE

- a. Slate is a natural dense rock material which splits easily into thin sheets and makes a durable roof. It is more expensive than asbestos shingles. Because of the weight of slate (from 700 to 1400 lbs. per square) the roof framing should be heavier than required for asphalt, asbestos or wood shingles.
- b. *Use:* Slate is used on roofs with a pitch of at least 5 to 12.
- c. *Type:* Each piece of slate should be machine-punched for 2 nails and no broken slate should be used. Slate is often specified by designating the quarries or by requiring the slate to comply with Fed. Spec. SS-S-451, *Grade A* or *B*. (There is also a *Grade C* with greatest absorption and least resistance to acid.)
- d. *Texture* should be specified by designating one of the following:

Rough surfaces with even edges  
 Rough surfaces with uneven edges  
 Smooth surfaces with even edges  
 Smooth surfaces with uneven edges

- 1. Slate from Maine and Pennsylvania, soft vein, are smooth split only.
- 2. Slate from Vermont and Pennsylvania are hard vein, and slate from Virginia are smooth and rough split.
- 3. Slate from Peach Bottom, Pennsylvania, are rough split only.
- e. *Colors:* Acceptable color or colors should be mentioned and selected from the following:

Black	Blue Gray	Green
Blue Black	Purple	Purple Variegated
Gray	Mottled Purple and Green	Red

If a definite color effect in Grade A is desired, these color designations should be preceded by the word *unfading* or *weathering*.

- f. *Size:* Slate for small buildings is often specified to be at least  $\frac{3}{16}$ " thick and 16" long, of random widths from 8" to 14" laid with a 3" head lap and a  $6\frac{1}{2}$ " exposure and 10" starters. (Other lengths, widths, exposures and starters may be selected from the following table.)
- g. *Graduated Lengths:* It should be mentioned here that architects specify graduated lengths with the larger slate used at the eaves and smaller slate near the ridges. This may be accomplished by specifying the first 12 courses to have an exposure of  $6\frac{1}{2}$ ", the next 14 courses  $5\frac{1}{2}$ ", and the remaining courses  $4\frac{1}{2}$ " (or some other combination).
- h. *Application:* Slate should be laid in courses parallel with the eaves,

<i>Length of Slate ("")</i>	<i>Range of Widths per Length ("")</i>	<i>Exposure Based on 3" Head Lap ("")</i>	<i>Length of Starter ("")</i>
24	12 to 16	10½	14
22	11 to 16	9½	13
20	10 to 16	8½	12
18	9 to 14	7½	11
16	8 to 14	6½	10
14	7 to 12	5½	9
12	6 to 12	4½	8
10	6 to 10	3½	7

doubled at the eave line and projecting 2" at the eaves and 1" at the gable ends. A ¼" wood strip should be installed at the eave line to give the starter course the proper slant. Slate should be fastened with large head slater's, solid copper nails using 3d (1¼") nails for slate 18" or less in length and 4d (1½") for slate 20" or longer add 6d (2") for slate on hips and ridges. Place nails so as not to pierce flashing. Slate along gable rakes should be bedded in elastic cement.

- i. *Hips and Ridges* are most often specified to be saddled type (Boston type or mitered type are sometimes specified) without metal flashing underneath. The nails of the combing slate should pass through the joints of the slate below. Hip and ridge slate should be laid in elastic cement and nail heads pointed with elastic cement colored to match as nearly as possible the color of the slate.
- j. *Valley and Base Flashing* may be specified the same as described for asbestos shingles in 19-5 e, f and g, above.

#### 19-7 TILE

- a. Most tile are made from burnt clay or shale and are the best and usually the most expensive roof covering for pitched roofs. Heavy framing has to be provided to support the heavy tile roofing weighing from 800 to 2,000 lbs. per square.
- b. *Use:* Tile may be used as roofing material on pitched roofs of structures where initial cost is not an important factor.
- c. *Type:* It is best to specify tile by designating the manufacturer and using the proper trade name for one of the following types of tile:
  1. *Flat Shingle Tile*
  2. *Interlocking Shingle Tile*
  3. *French Tile*
  4. *Spanish Tile*
  5. *Mission Tile*
  6. *Greek Tile*
  7. *Roman Tile*

It should also be mentioned that color will be selected by the Architect and that special tile shall be provided for hip and ridge roll, for eave and rake closures, for starters and for valleys.

- d. *Application:* Tile should be specified to be laid in full accordance with the manufacturer's direction sheets using copper nails of proper size to penetrate the roof sheathing  $\frac{3}{4}$ ". Roofing cement as recommended by the manufacturer of the tile and 1:3 portland cement mortar should be used.
- e. *Valleys* should be specified to be open type same as 19-5 e.
- f. *Base Flashing* requirement should be the same as 19-5 g.

#### 19-8 BUILT-UP ROOFING

- a. Built-up roofing is roofing made up of alternate layers of saturated felt and moppings of hot asphalt or coal tar pitch, protected by a top covering of slag, gravel or marble chips. The use of asphalt or pitch is often made optional with the Contractor. Often the names of several acceptable nationally known roofing manufacturers are mentioned and the installation required to be done by one of their recognized dealers.
- b. *Use:* Built-up roofs are installed on comparatively flat roofs with inclines usually not exceeding 3" to 1' 0". The incline on built-up roofs is usually not less than  $\frac{1}{8}$ " to the foot unless the Architect deliberately wants water to stand on the roof. Built-up roofing is often specified to be installed on all low inclined roofs.
- c. *Built-up Roofing Materials* should comply with the following:

Coal Tar Pitch, Type A .....	ASTM Spec. D450
Asphalt .....	ASTM Spec. D312
Coal-tar-saturated Felt .....	ASTM Spec. D227
Asphalt-saturated Felt .....	ASTM Spec. D226

Gravel, slag or marble chips should be hard, durable and dry, and should be free from sand, dirt, clay or other substances. Gravel, slag or marble chips should be graded from  $\frac{1}{4}$ " to  $\frac{5}{8}$ " in size. Slag should be crushed, blast-furnace slag; marble chips should be of white marble.

- d. *Type:* Built-up roofing may be specified to be made up of alternate layers of saturated felts and asphalt or coal tar pitch, surfaced with gravel, slag or marble chips. Built-up roofing should be installed in full accordance with manufacturer's specifications for a 20-year (15-year or 10-year) bonded roof of one of the nationally known built-up roofing manufacturers.
- e. *Alternate:* One layer of mineral-surfaced cap sheet, minimum weight 85 lbs. per square, may be specified in lieu of top ply and gravel, slag or marble chip surfacing.

- f. *Base Flashing for Built-up Roofs* should be of saturated felts and asphalt or coal tar pitch in full accordance with manufacturer's specifications, for bonded base flashing of the same period of time as mentioned for the roofing.

### 19-9 SHEET METAL WORK

- a. *Sheet Metal*: The various items fabricated from sheet metal are generally specified individually, but there is usually a paragraph calling for the more expensive corrosion resistant copper or the less expensive galvanized copper steel which has to be painted:
1. *Sheet Metal*, except as otherwise specified, shall be 16 ounce (0.0216") cold rolled, cornice temper, copper meeting the requirements of ASTM Spec. B152, *Type ETP* (electrolytic tough pitch) or *Type FRTP* (fire-refined tough pitch).
  - or
  2. *Sheet Metal*, except as otherwise specified, shall be 26 gauge galvanized, cold rolled, copper steel meeting the requirements of ASTM Spec. A361, and surfaces shall be treated chemically to provide a phosphate paint holding film.
- b. *Gravel Stops* are required to be placed at all exposed edges of built-up roofs. Gravel stops should be one piece in width and should project out on roof not less than 4" and be nailed on top of built-up roofing felts with nails embedded in roofing asphalt or pitch, and then covered with 2 layers of felt well mopped in place. The bottom ply at eave lines should be turned back over the ends of other plies to prevent asphalt or pitch from *bleeding* out.

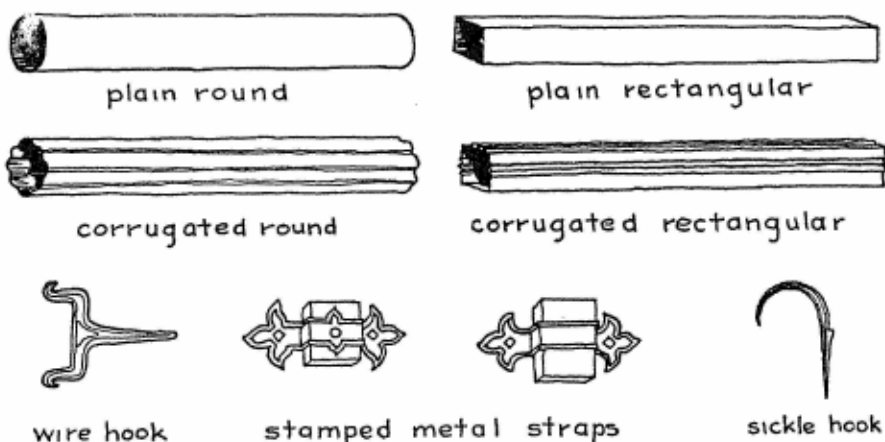


FIG. 19-3 DOWNSPOUTS AND ACCESSORIES



- c. *Cap Flashing*: All base flashing should be counter-flashed with sheet metal extending into masonry walls  $\frac{3}{4}$ " and turning up  $\frac{1}{4}$ ", caulked in place. Cap flashing should extend down over base flashing at least 4" and should have a  $\frac{1}{2}$ " seam at bottom.
- d. *Downspouts* (Figure 19-3) should be of sheet metal and type and size specified (see Table 19-1 for types and sizes). Downspouts should be

TABLE 19-1. MAXIMUM ROOF AREAS DOWNSPOUTS WILL ACCOMMODATE

<i>Size and Type of Downspout</i>	<i>Pitched Roof (sq. ft.)</i>	<i>Flat Roof (sq. ft.)</i>
3" Diameter Plain Round	1061	1414
4" " " "	1886	2514
5" " " "	2945	3926
6" " " "	4241	5654
3" Diameter Corrugated Round	891	1188
4" " " "	1656	2208
5" " " "	2658	3544
6" " " "	3896	5194
1 $\frac{3}{4}$ " x 2 $\frac{1}{4}$ " Plain Rectangular	591	788
2" x 3" " "	900	1200
2" x 4" " "	1200	1600
3" x 4" " "	1800	2400
4" x 5" " "	3000	4000
4" x 6" " "	3600	4800
1 $\frac{3}{4}$ " x 2 $\frac{1}{4}$ " Corrugated Rectangular	570	760
2 $\frac{3}{4}$ " x 3 $\frac{1}{4}$ " " "	1160	1546
2 $\frac{3}{4}$ " x 4 $\frac{1}{4}$ " " "	1755	2340
3 $\frac{3}{4}$ " x 5" " "	2813	3750

This table based upon 150 sq. ft. of roof area per 1 sq. in. of downspout for *pitched* roofs and 200 sq. ft. of roof area per 1 sq. in. of downspout for *flat* roofs.

More accurate results can be obtained by calculations based on actual rainfall in the location; in comparatively dry locations more square footage of roof area can be accommodated for each size downspout than is listed above.

cemented into boots of drainage system (or equipped with elbows to empty onto splash blocks). Downspouts should be supported by stamped sheet metal bands (or by wired malleable iron hooks when backing is masonry) spaced not over 10' 0" o.c. (*Downspouts* are sometimes called *leaders* or *conductors*.)

- e. *Gutters* (Figure 19-4) are often specified to be of sheet metal and also:

1. Of form indicated on the drawings, or
2. Of standard half-round single bead type, or
3. Of standard half-round double bead type, or
4. Of standard ogee type.

Size of gutters for residences is usually specified to be 5". Other standard sizes are 3 $\frac{1}{2}$ ", 6", 7" and 8".

Gutters should be specified to be supported approximately 4' 0" (or

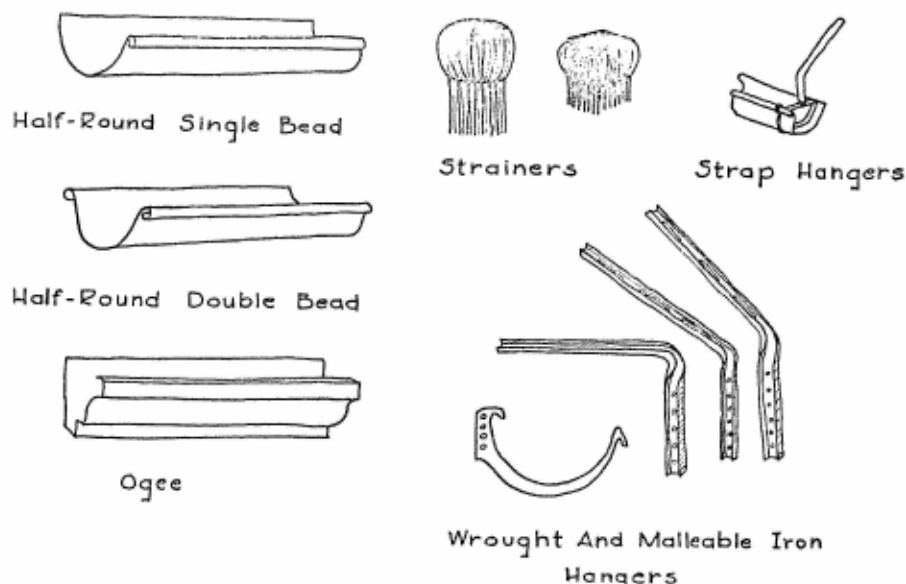


FIG. 19-4 GUTTERS AND ACCESSORIES

3' 0" o.c. with strap hangers (or wrought and malleable iron adjustable hangers).

- f. *Strainers* (Figure 19-4) should be installed in all gutter outlets to downspouts. Strainers should be of copper (or galvanized steel) wire.
- g. *Sill Protection* (Figure 19-5): At all joints where wood timbers such as sills come in contact with or are adjacent to an earth fill for concrete floor slab, the timber should be protected against moisture with sheet metal (or 3-oz. fabric-covered copper).
- h. *Termite Shields* (Figure 19-5): Sheet metal termite shields should be placed on top of all foundation walls and piers. Shields should extend beyond the edge of walls and piers 2" on all sides and be bent down at a 45-degree angle. Corners should be mitered and all joints soldered. For termite infested areas of the United States see Figure 17-6.

## 19-10 METAL ROOFING

- a. Metal roofing of copper or terne metal has been used on residences for many years. It is suitable for either comparatively flat roofs or pitched roofs. Copper roofing is considerably more expensive than terne metal roofing but is more durable without maintenance. Terne metal roofing has to be painted periodically to keep it from deteriorating.
- b. *Use*: The specification paragraph should stipulate that metal roofing

shall be installed over all roofs indicated on the drawings to have metal roofing.

- c. *Types and Sizes:* Metal roofs are usually specified to be formed from one of the following:

1. *Sheet Copper* cold rolled cornice temper, weighing 16 oz. per sq. ft., in 24" x 96" sheets (for other weights and sizes used, see Table 19-2).

TABLE 19-2. WEIGHTS AND SIZES OF SHEETS FOR COPPER ROOFING

	<i>Sheet Size</i>	<i>Gauge Weight</i>	<i>Max. Flat Width Between Standing Seams</i>
Roof Pans for Standing Seam Copper Roofs	16" x 72"	10 oz.	13 $\frac{3}{4}$ "
	20" x 96"	16 oz.	16 $\frac{3}{4}$ "
	<i>Sheet Size</i>	<i>Gauge Weight</i>	
Roof Pans for Batten Seam Copper Roofs	24" x 96"	16 oz.	
	30" x 96"	20 oz.	
	<i>Sheet Size</i>	<i>Gauge Weight</i>	<i>Size of Squares</i>
Roofing Squares for Flat Lock Seam Copper Roofing	36" x 96"	16 oz.	12" x 16"
	36" x 96"	20 oz.	18" x 24"

This table from Catalog of The American Brass Company, Waterbury 20, Conn.

2. *Terne Metal* of copper bearing steel dip coated with alloy of approximately 80% lead and 20% tin. Base plate to be IX gauge approximately 0.0155" (or IC gauge approximately 0.0122") and coating of 40 lbs. per 436 sq. ft. (or 20 lbs. per 436 sq. ft.). Terne metal is available in seamless 50-foot rolls (eliminating the need of cross seams) of the following widths: 4", 6", 7", 8", 10" and 12" for valleys, copings and flashing, and 14", 20", 24" and 28" for roofing.
- d. *Building Paper and Felts:* It is generally specified for copper roofing that 30-lb. (or 15-lb.) asphalt- or tar-saturated felt first shall be laid attached to sheathing by copper nails, using copper cleats and folding them over the nail heads. For terne roofing, specifications usually call for 20-lb. rosin-sized building paper; the asphalt- and tar-saturated felts should never be used.
- e. *Solder and Flux:* Metal solder for copper and terne metal is usually specified to be 50% lead and 50% tin, but the flux for copper is specified to

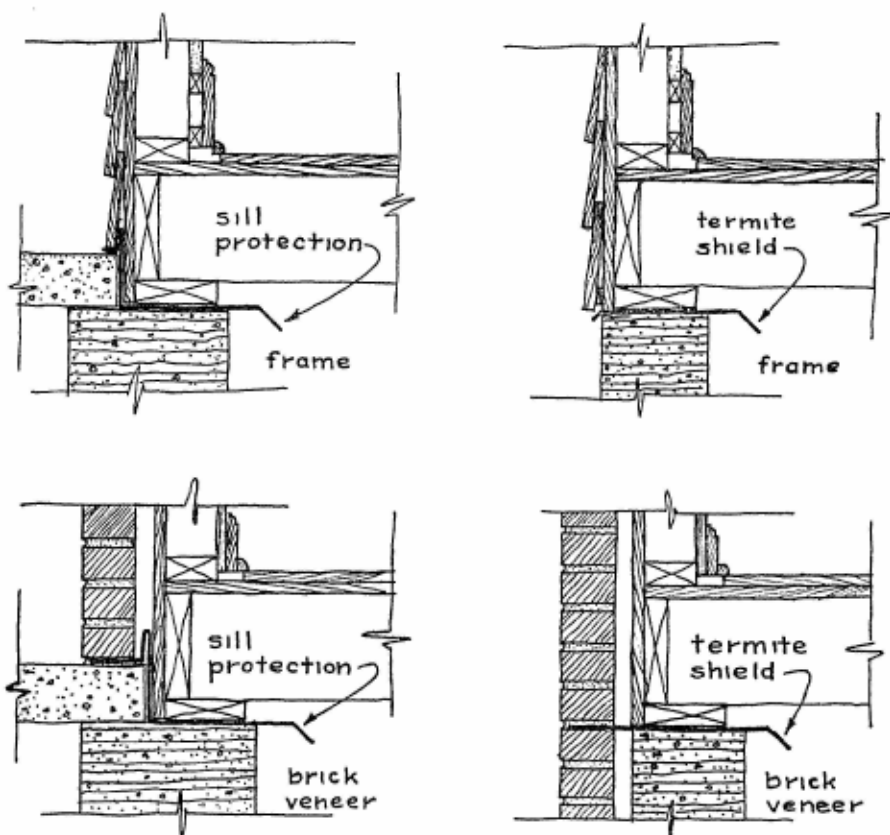


FIG. 19-5 SILL PROTECTION AND TERMITE SHIELD

be muriatic acid killed with zinc or a nonacid flux in paste form, while the flux for terne metal is specified to be rosin only and acid flux is prohibited.

- f. *Priming Terne Roofing:* The lower side of each sheet of terne roofing should be primed at the mill or shop and the upper side should be primed immediately after installation with red oxide of iron and oil paint. (Other coats on finish surfaces are specified in *Painting* section.)
- g. *Installation of Flat Seam Roofing:* Flat seams are used often for comparatively flat ( $\frac{1}{2}$ " to the foot) roofs and the installation requirements may be written as follows:
  1. "Seams shall be made by turning the edges  $\frac{1}{2}$ " on one edge and 1" along the other and by locking and soldering. Cross seams shall be staggered. The seams at ridges and hips shall be raised (or flat). Mallet all seams being careful to avoid buckling."

2. "Cleats shall be installed from 8" to 12" o.c. and held in place with two  $\frac{7}{8}$ " copper nails (zinc-coated nails for terne metal roofing) and end of cleat folded over nail heads. Cleats shall be  $1\frac{1}{2}$ " wide by 3" long made of same material as roofing. No nails shall be driven through the roofing."
- h. *Installation of Standing Seam Roofing* (Alternate for Flat Seam Roofing): Standing seams are used often for pitched roofs and the installation requirements may be written as follows:
  1. "Seams shall be made by turning the edges  $1\frac{1}{4}$ " on one edge and  $1\frac{1}{2}$ " on the other. Fold over  $\frac{1}{4}$ " of one sheet, then fold over  $\frac{1}{4}$ " of the whole seam to form double-locked standing seams 1" high. Press the seams tightly together. Cross seams shall be  $\frac{3}{4}$ " loose lock seams (or  $\frac{3}{4}$ " soldered seams if pitch of roof is slight)."
  2. "Cleats shall be installed from 8" to 12" o.c. and held in place with two  $\frac{7}{8}$ " copper nails (zinc-coated nails for terne metal roofing), and end of cleat folded over nail heads. Cleats shall be  $1\frac{1}{2}$ " wide by  $3\frac{1}{2}$ " long made of same material as roofing. No nails shall be driven through the roofing."
- i. *Batten Type Roofing*: Another way to install metal roofs is to first strip the roof with wood battens sometimes 2" high by  $2\frac{1}{2}$ " wide and lock the copper over the battens. The paragraph covering the installation for this type should be prepared based upon the particular design and details.

## CHAPTER 20

# Weatherstripping, Insulation, Caulking and Glazing

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### 20-1 GENERAL

- a. Although weatherstripping, insulation, caulking and glazing are often handled by separate Subcontractors and for that reason should be specified in separate sections, there is usually so little to be written about each on a residence that it is logical to group them together in one section. Weatherstripping, insulation, caulking and glazing are closely related in respect to weatherproofing a house.
- b. Figure 20-1 indicates the fuel that might be saved by means of various forms of weatherproofing and insulation. Even in the mild climates of the United States insulation is often installed in ceilings or roofs more to keep the heat out in the hot weather than to conserve fuel in the winter, and doors are often weatherstripped, although the windows may not be. In cold regions of the United States, all forms of weatherproofing and insulating are employed and the initial cost is soon absorbed by the saving in fuel used for heating and in electricity used for air conditioning.

### 20-2 WEATHERSTRIPPING

- a. There are many types of weatherstripping developed for the many types of windows and doors manufactured, but the most usual types for residential work are as follows:
- b. *Weatherstripping Double-Hung Windows:* Double-hung wood windows, except windows of the Garage, should be weatherstripped with not less than 9 gauge cross-grain zinc strips. The strips should be tongue type, and for sides and sills should be of width equal to the thickness of the sash. Strips for sides should be corrugated for stiffness and strips for meeting rails should interlock. Installation should be according to manufacturer's standards and fastened with steel nails not over  $1\frac{1}{2}$ " apart.

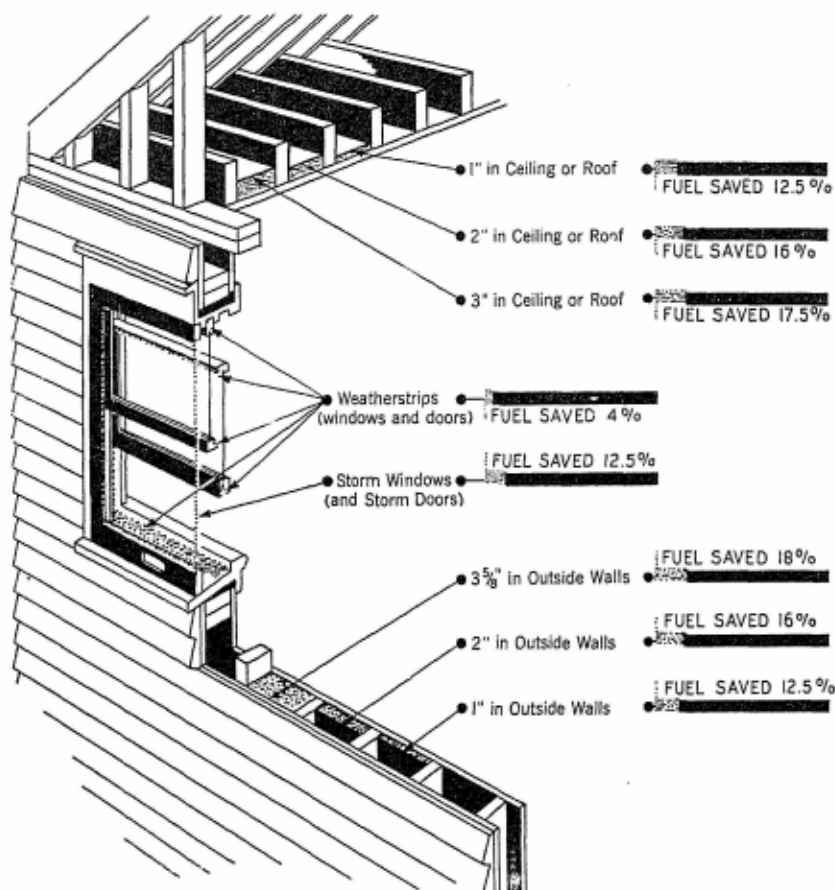


FIG. 20-1 FUEL SAVINGS BY MEANS OF WEATHERSTRIPPING AND INSULATION  
(From Miscellaneous Publication No. 663, U. S. Department of Agriculture)

- c. *Weatherstripping Doors:* Exterior doors, except Garage doors, should be weatherstripped with spring bronze strips not less than 32 B&S gauge. Strips for heads and sides should be not less than  $1\frac{3}{8}$ " for  $1\frac{3}{4}$ " doors ( $1\frac{1}{8}$ " for  $1\frac{3}{8}$ " doors and  $1\frac{1}{2}$ " for  $2\frac{1}{4}$ ") fastened with bronze nails 1" o.c. Bronze (or aluminum) hook strips not less than 0.014" thick should be fastened to bottom of door with screws not over 3" o.c.
- d. *Weatherstripping Wood Casement Windows:* Wood casement windows are specified to be weatherstripped with spring bronze equipment the same as specified for doors, except spring bronze strip should be used for the sills in lieu of hook strip, or wood casement windows may be specified to be weatherstripped with zinc strips, tongue type for the hinged sides and interlocking type for meeting stiles, top and sill.

- e. *Weatherstripping Metal Windows:* If weatherstripping is required for metal windows, it is generally specified (in another section) to be furnished with the windows.
- f. *Sliding Doors, Side Sliding Windows, Awning Type Windows* and the like require special weatherstripping equipment and the weatherstrip-

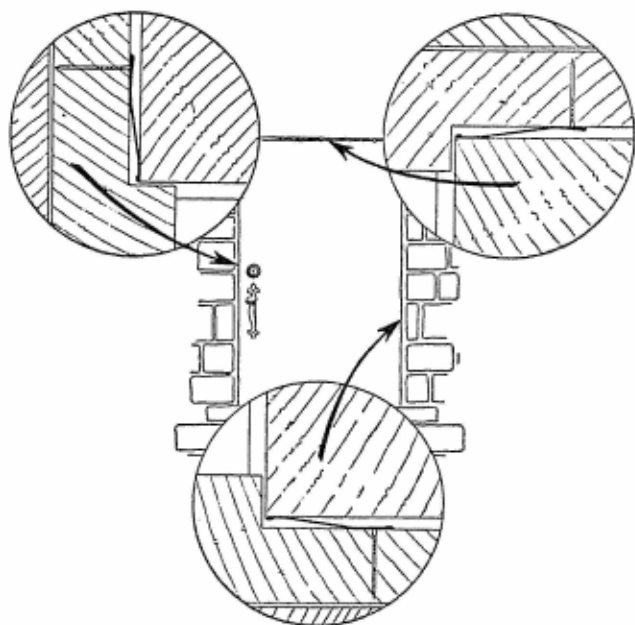


FIG. 20-2 WEATHERSTRIPPING DOOR  
From catalog of Accurate Metal Weatherstripping Co.

ping manufacturer's catalogs should be examined and the local representative consulted before writing the requirements.

### 20-3 INTERLOCKING TYPE METAL THRESHOLDS

There are many different types of interlocking metal thresholds but the most common types for residences might be specified as follows:

"Main entrance door shall be equipped with threshold not less than 5" wide and  $\frac{7}{8}$ " high. Doors to Porch shall be equipped with thresholds not less than  $3\frac{1}{2}$ " wide and  $\frac{9}{16}$ " high. Door to Kitchen shall be equipped with an oak sill piece and threshold not less than  $1\frac{3}{8}$ " wide and  $\frac{1}{4}$ " high. Thresholds shall be interlocking type of extruded bronze (or aluminum). Thresholds shall be drilled for countersunk anchor screws."



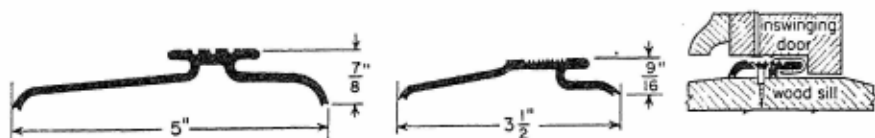


FIG. 20-3 INTERLOCKING THRESHOLDS

## 20-4 THERMAL INSULATION

- a. Thermal Insulation of the wallboard type made usually of wood or vegetable fibers is generally specified in *Rough Carpentry* section.
- b. *Use:* Thermal insulation for frame buildings is usually specified to be placed between all ceiling joists except ceiling joists over Porches, Car Ports (or Garages) and between studs of all exterior walls (except exterior walls of Garage).
- c. *Type and Size:* One type of insulation used extensively in frame type buildings is made of lightweight mineral matter and a sentence describing it for bat or strip type might read as follows:

"Insulation shall be of mineral matter meeting the requirements of Fed. Spec. HH-I-521c, and shall be *Type I*, bat form, *Class A*, lightweight, and shall be not less than  $3\frac{3}{8}$ " thick."

- d. If loose-fill type is desired the sentence could read:

"Insulation shall be of mineral matter meeting the requirements of Fed. Spec. HH-I-521c and shall be *Type II*, loose-fill form, *Class A*, lightweight, and shall be pneumatically applied to a uniform thickness not less than 4" between joists and to completely fill space between studs."

- e. It might be added here that it is much easier to supervise the installation of the bat form of insulation.
- f. *Other Types of Insulation* specified for installation between studs and joists include:
  1. *Vegetable or Wood Fiber Insulation*, meeting the requirements of Fed. Spec. HH-I-515, flexible blanket.
  2. *Cotton Bat Insulation*, meeting the requirements of Fed. Spec. HH-I-528a.
  3. *Shredded Redwood-Bark Loose-Fill Insulation*, meeting the requirements of Fed. Spec. LLL-I-533.
  4. *Bright Metal Types of Insulation*, possessing high reflecting power.
  5. *Sprayed on Type of Insulation*.
- g. *Installation:* Mention might be made that the installation shall be in full accordance with manufacturer's printed instructions.

## 20-5 CAULKING

- a. *Caulking* is the application of mastic into cracks or crevices to seal them against the weather. It is required where metal frames or wooden brick mouldings abut masonry on the exterior to close up the void between the materials.
- b. *Use*: It is often specified that, after exterior door and window frames are built in, caulking compound shall be applied with a gun between brick mouldings of wood frames and masonry, between all metal frames and masonry and under all exterior wood sills and metal thresholds.
- c. *Type*: The caulking compound may be specified by reference to trade names or by calling for a caulking compound meeting the requirements of Fed. Spec. TT-C-598, *Grade 1* for gun application (*Grade 2* is for knife application).
- d. *Thiokol*: There is a type of caulking compound made of *THIOKOL* and sold under several brand names. This caulking compound is superior to the conventional type mentioned immediately above, but is more expensive and more difficult to apply. It adheres well to many type surfaces and dries into a flexible mass with the characteristics of rubber.

## 20-6 GLASS

- a. Glass is most easily specified by requiring it to meet the requirements of Fed. Spec. DD-G-451a.
- b. *Polished Plate Glass* is the best flat glass available. It is a glass from which surface irregularities have been removed by grinding and polishing both surfaces.
  - 1. *Use*: In residential work plate glass is specified for glazing large panels and picture windows. When initial cost is not a factor and the best is desired, it is specified for glazing windows and doors.
  - 2. *Quality* specified for glazing is known as *Glazing Quality* (other qualities are *Silvering* and *Mirror Glazing*).
  - 3. *Thicknesses* usually specified are:
    - $\frac{1}{8}$ " for small panes
    - $\frac{1}{4}$ " for large panels, picture windows and door glazing(Other thicknesses include  $\frac{13}{64}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{3}{4}$ ",  $\frac{7}{8}$ " and 1" and  $1\frac{1}{4}$ ".)
- c. *Clear Sheet Glass* is glass made by the flat drawn process.
  - 1. *Use*: Most commonly used glass for door and window glazing. Many residences are glazed with this type of glass throughout.
  - 2. *Quality* generally specified for better work is *A* and for low-cost work is *B*. (Other qualities include *AA*, the highest, which is rarely

specified, and *Double Strength Greenhouse*, the lowest, specified only for greenhouses.)

3. *Thicknesses* usually specified are *Single Strength* for wood windows with small panes, *Double Strength* for metal windows and for wood windows with large panes, and  $\frac{3}{16}$ " or  $\frac{7}{32}$ " for panels not exceeding 76" x 120" where slight distortion is not objectionable. There are many other thicknesses made, but they are rarely used in construction work.

*Note:* The trade understands them well and for simplification in writing the following abbreviations are used:

*SSA* for *Single Strength, A Quality*

*SSB* for *Single Strength, B Quality*

*DSA* for *Double Strength, A Quality*

*DSB* for *Double Strength, B Quality*

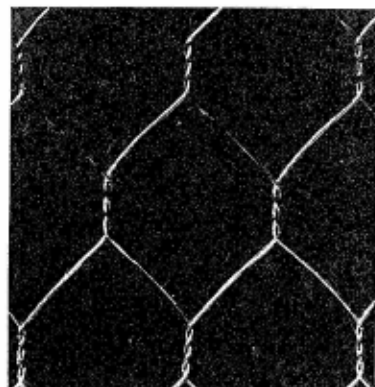
Double strength and single strength glass are generally called *Window Glass* by the trade and  $\frac{3}{16}$ " and  $\frac{7}{32}$ " glass are referred to as *Heavy Sheet Glass*. (*Crystal Sheet* is a type of glass used for table ware and is incorrect for describing this type of glass for glazing purposes.)

- d. *Gray Sheet Glass*, such as Lustragray as manufactured by the American-Saint Gobain Corporation and Pennvernon Graylite as manufactured by the Pittsburgh Plate Glass Company, is being used more and more for glazing. It reduces glare, absorbs heat, increases privacy and complements all colors. It is made in the following strengths and sizes:

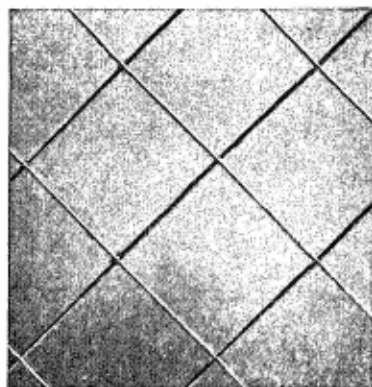
Double strength	60" x 80"
$\frac{3}{16}$ " thick	72" x 120"
$\frac{7}{32}$ " thick	72" x 120"
$\frac{1}{4}$ " thick	72" x 120"

- e. *Wire Glass* (Figure 20-4) is a glass made with a reinforcing metal mesh embedded in the glass.

1. *Use:* Wire glass is used extensively in commercial and industrial work to meet the fire code requirements, but is rarely used in residential work.
2. *Types* generally specified are clear polished wire glass with conventional hexagonal mesh, or *Nuweld* or *Misco* clear polished wire glass. (Wire glass is also available in many other patterns and in heat absorbing glass.)
3. *Thickness:* Usual thickness specified is  $\frac{1}{4}$ " (other thicknesses are  $\frac{3}{8}$ " and  $\frac{1}{2}$ ").
4. *Installation:* If hexagonal mesh is specified, it would be well to men-



Hexagonal Mesh

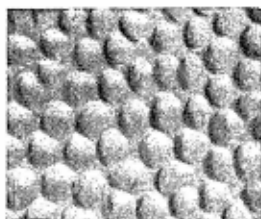


Nuweld, Misco or Georgian

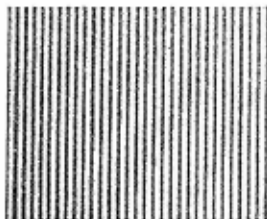
FIG. 20-4 POLISHED WIRE GLASS (Courtesy Blue Ridge Glass Co.)

tion that the direction of the twist shall run vertically (or horizontally). If *Nuweld* or *Misco* is specified the wires will probably be run diagonally, which is standard, unless other requirement is made. If *Georgian* is specified, the wires will probably be run vertically and horizontally, unless other requirement is made.

- f. *Figured Glass* (Figures 20-5, 20-6, 20-7, and 20-8) or patterned glass is glass produced with geometric or linear designs impressed into one or both surfaces. All are semitransparent.
  1. *Use:* Figured glass is used for obstructing vision and diffusing light. In commercial work it is used extensively for glazing skylights, office partitions and screens, and for glazing windows of toilets and locker rooms. In residential work it is sometimes used for decorative panels and cupboard doors.
  2. *Type* is most easily specified by designating the pattern trade names as listed in Figures 20-5, 20-6 and 20-7.
  3. *Thicknesses:* The thickness usually specified for small panels is  $\frac{1}{8}$ " (except *Doublex* which is made in  $\frac{3}{32}$ " thickness only) and for larger panels  $\frac{3}{16}$ " (*Ribbed* and *Hammered* are also made in  $\frac{3}{8}$ " and  $\frac{1}{2}$ " thicknesses).
  4. *Finishes:* If no finish is specified, the figured glass will probably be furnished with *Plain Rolled Fire Finish*. Other finishes specified are described below under *Processed Glass*.
  5. *Installation:* It is usually specified that the figured side of patterned glass shall face the interior. For linear designs the specification writer should stipulate whether the pattern is to run horizontally or vertically.



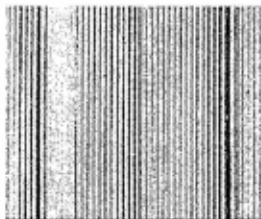
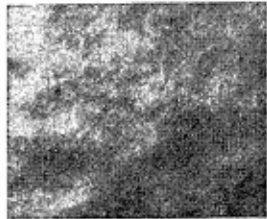
Hammered



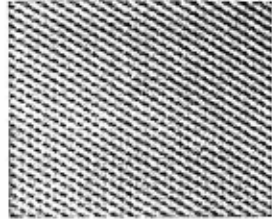
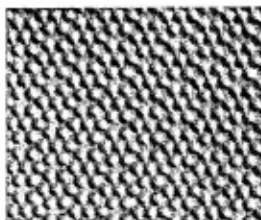
Ribbed



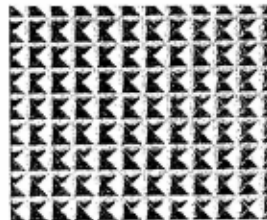
Luminex, Hylite or Rough

Skytex, Pentecor, Riblite  
or Corduroy

Velvex, Luxlite or Dappled

Industrex, Factrolite or  
Crossnet

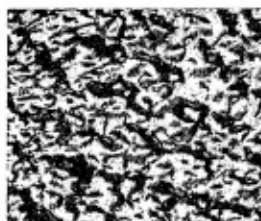
Diffuse or Dewlite



Reglex, Prestlite or Pyramid



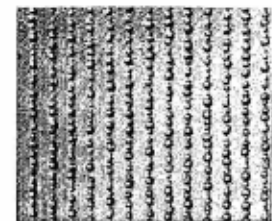
Pointex or Artex



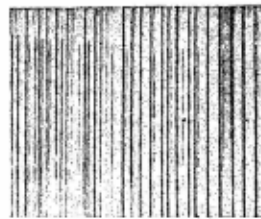
Pebblex or Syenite



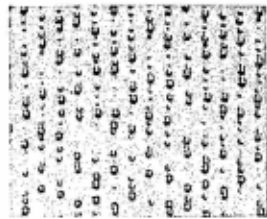
Florex or Florentine



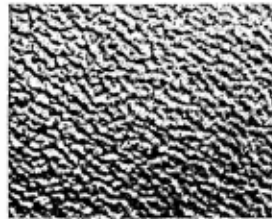
Beadex Matte



Randex



Beadex



Muralex

FIG. 20-5 PATTERNS OF FIGURED GLASS (Courtesy American-Saint Gobain Corp.)

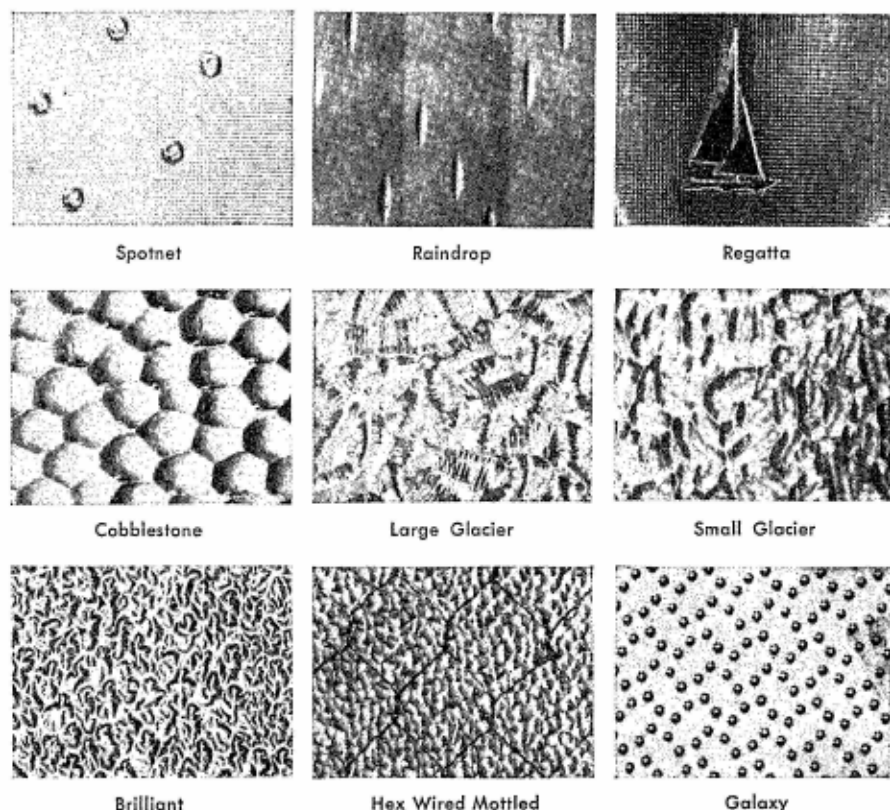
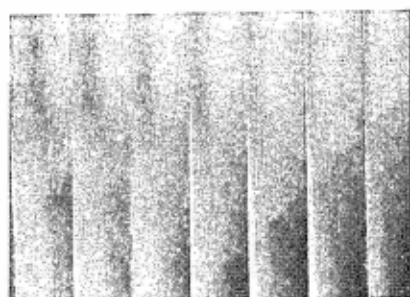


FIG. 20-6 PATTERNS OF FIGURED GLASS (Courtesy Libbey-Owens-Ford Glass Co.)

g. *Processed Glass* is glass whose surface has been altered by etching, sandblasting, chipping or grinding. The following finishes are often specified to be applied to sheet or figured glass:

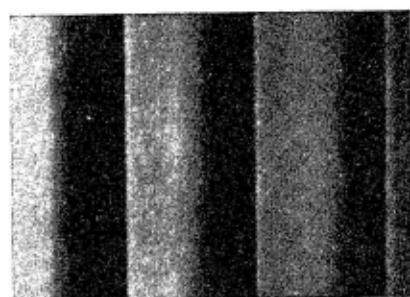
1. *Satinol or Softone Finish* for one or both surfaces to increase obscurity and diffusion of transmitted light. This reduces light transmission approximately 3% if one surface is treated and approximately 6% if both surfaces are treated. This finish is also applied in designs; see Figure 20-8.
2. *Frosted Finish*: Acid etching of one or both glass surfaces to improve distribution of transmitted light. This finish is used for glass over light fixtures.
3. *Sandblasted Finish* for one or both surfaces to increase obscurity and diffusion of transmitted light. This reduces light transmission about 16% if one surface is treated and about 20% to 30% if both sur-



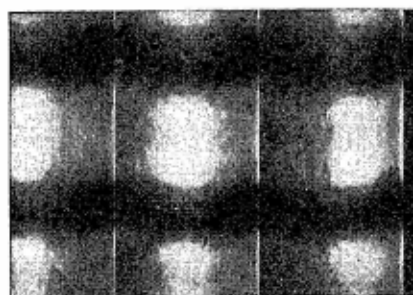
Linex or Narrow Colonnade



Louvre or Bevelite



Flutex or Bandlite or Colonnade



Doublex or Magnalite A

FIG. 20-7 PATTERNS OF FIGURED GLASS (Courtesy American-Saint Gobain Corp.)

faces are treated. The rough surface of this finish fills with dirt and is hard to clean; therefore, it is seldom specified.

*h. Insulating Glass* (Figure 20-9): Insulating glass is a factory-built transparent (or obscure) glass unit composed of two (or more) lights of glass separated by a dehydrated air space, hermetically sealed around the edges with metal.

1. *Use:* This glass is used primarily to conserve heat in colder regions, and is also used to reduce noise transmission and to reduce cost of operation of air-conditioning systems.
2. *Type:* Insulating glass may be specified by calling for it by the trade names of *Thermopane* or *Twindow* and mentioning one of the following grades where clear glazing and standard sizes are required:

Two panes of *DSA* glass with  $\frac{1}{4}$ " air space

Two panes of  $\frac{1}{8}$ " *Polished Plate* glass with  $\frac{1}{4}$ " air space

Two panes of  $\frac{3}{16}$ " *Heavy Sheet* glass with  $\frac{1}{4}$ " air space

Two panes of  $\frac{3}{16}$ " *Heavy Sheet* glass with  $\frac{1}{2}$ " air space

Two panes of  $\frac{1}{4}$ " *Polished Plate* glass with  $\frac{1}{2}$ " air space

## DESIGNED SATINOL

Some standard patterned glasses may be further enhanced by the additional surface treatment of Designed Satinol. On lighter glass patterns the Designed Satinol becomes the major decorative motif. On others the patterns and designs complement each other. When specifying give type, pattern and design by name and number. Thus: "Standard Muralux  $\frac{1}{8}$ " Designed Satinol No. 506"

Designed Satinol is available in standard type,  $\frac{1}{8}$ " thickness, one side only in the following patterns:

pattern	designs available
Flutex	no. 504 no. 507 *
Muralux	all designs
Industrex	all designs
Linex	no. 503 * no. 504 no. 506 * no. 507 * no. 508 *
Louvrex	no. 504 no. 507 *
Luminex	all designs

\* Large area only.

\* Axis of pattern parallel to axis of texture.

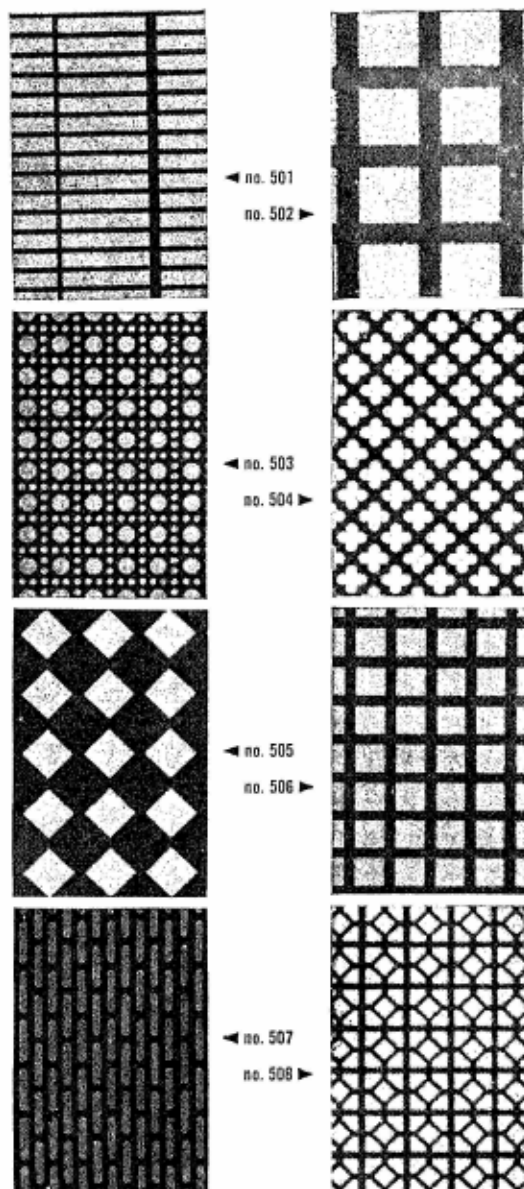


FIG. 20-8 DESIGNED SATINOL PATTERNED GLASS (Courtesy American-Saint Gobain Corp.)

When nonstandard sizes are used many more combinations may be specified.

3. *Sizes:* It is a saving to design for and specify standard sizes. The four standard thicknesses are approximately  $\frac{1}{2}$ ",  $\frac{5}{8}$ ",  $\frac{7}{8}$ " and 1" and



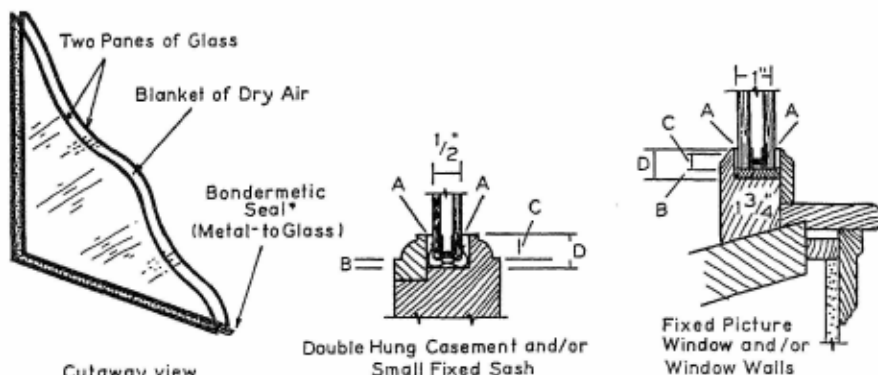


FIG. 20-9 INSULATING GLASS (Courtesy Libbey-Owens-Ford Glass Co.)

many standard widths and heights are permitted by the manufacturers in their catalogs.

4. *Installation* should be specified to be in full accordance with manufacturer's recommendations without using putty but using special glazing compound, setting blocks or glazing clips as recommended by the manufacturer.
- i. *Other Types of Glass* for special purposes not discussed in this text include:

Corrugated glass	Heat absorbing glass
Safety and bullet resisting glass	Mirrors
Tinted plate glass	Tempered plate glass
Structural glass	Tempered rolled glass

## 20-7 GLAZING PUTTY

- a. *Glazing Putty* is a compound used for sealing glass into frames and may be specified by manufacturer's brand names or as follows:
- b. *Putty for Glazing Wood Sash* shall meet the requirements of Fed. Spec. TT-P-791a, *Type II*. (*Type II* is harder than *Type I* and is probably more durable.)
- c. *Putty for Glazing Metal Sash* shall meet the requirements of Fed. Spec. TT-P-781a, *Type I*. (*Type II* is of lower quality than *Type I*.)
- d. *Thiokol* compounds are also being used for glazing. They are superior to putty, but also more expensive.

## 20-8 GLAZING

A paragraph covering the installation of glass might read as follows:

"Glass shall be both back-puttied and face-puttied. No putty shall be applied for setting glass until rabbets for glazing and glazing beads have

been primed and painted. Sash shall be fixed in place until putty has set. Secure glass in wood sash with zinc glazing points and in metal sash with spring clips. Glass shall be left tightly placed and free from rattle. Glass in doors shall be set in putty and secured with wood stops on the interior."

#### **20-9 CLEANING AND REPLACING GLASS**

A paragraph covering the cleaning and replacing of glass might read as follows:

"Glass broken or glass damaged before completion of the building operations shall be replaced with glass of like kind and quality without cost to the Owner. Upon completion of all construction work and approval of glazing, labels shall be removed and glass shall be washed clean."

## CHAPTER 21

# Lath, Plaster and Stucco

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### 21-1 INGREDIENTS OF PLASTER

- a. The principal ingredients of plaster are a cement material and water to which is usually added an inert aggregate. The cement materials most commonly used are lime, gypsum, Keene's cement, portland cement or a combination thereof. Water is not only used to develop the plasticity of the cement materials but also to take part in the chemical reactions necessary in the hardening process.
- b. *Inert Aggregate* is added to the cement material not only to increase its mass by the addition of the often less expensive material, but also to reduce the shrinking caused by the rapid evaporation of water. Sand is the most common inert material used. Because of their lightweight and insulating qualities, *Vermiculite*, produced by expanding a special type of mica and, *Perlite*, produced by expanding volcanic rock, are used as aggregates in lieu of sand.
- c. *Hair and Fiber* are used also as inert aggregate and serve to reinforce the plaster while in a plastic state and thus facilitate its application and hold the bonding pieces together when forced through perforations of certain types of lath. Hair or fiber should always be used with plaster applied to expanded metal lath or other types of perforated lath.
- d. *Quicklime*, made by heating limestone, consists principally of calcium oxide or of calcium and magnesium oxides. Quicklime is sold in the form of white lumps or in pulverized particles. When water is added to quicklime, it causes a chemical reaction to take place known as slaking. If excess water is used, lime putty results.
- e. *Hydrated Lime* is made by slaking quicklime with just enough water to cause chemical reaction with no excess. This is sold in the form of dry white powder in paper bags and in two grades:
  1. *Mason's Hydrated Lime*, a grade suitable for masonry mortars.
  2. *Finishing Hydrated Lime*, with plasticity in the highest degree suitable for plaster.

## 21-2 GENERAL REQUIREMENTS

- a. *Standard Specifications:* Writing a section covering lathing and plastering is greatly simplified by requiring all work to be in full accordance with American Standards Association ASA Nos. A42.1 and A42.4 "Standard Specifications for Gypsum Plastering and Interior Lathing and Furring" approved by the American Institute of Architects and the American Society for Testing Materials.
- b. *Scaffolding:* It might be mentioned in the Lathing and Plastering section that the necessary scaffolding is included and the work is to be properly coordinated with the other trades.
- c. *Patching:* The specification writer might mention that the Plastering Contractor shall do all normal patching of plaster following the plumbing, heating and electrical work and the work of other trades.

## 21-3 WOOD LATH

Wood lath, used many years ago as a plaster base and consisting of wood strips  $\frac{5}{16}$ " x 1  $\frac{5}{16}$ " x 48" laid  $\frac{3}{8}$ " apart, is no longer used because gypsum lath serves the purpose better.

## 21-4 GYPSUM LATH

- a. Gypsum lath consists of gypsum sandwiched between absorbent paper which holds the plaster securely without keying. Gypsum lath is used extensively as a base for plaster in light frame construction.
- b. *Use:* The paragraph covering gypsum lath should establish that it shall be used as a plaster base for all plaster, except where otherwise specified, or where the plaster is to be applied directly to masonry or concrete surfaces.
- c. *Type and Size:* Gypsum lath is most easily specified by requiring it to conform to ASTM Spec. C37. The size is usually specified to be  $\frac{3}{8}$ " x 16" x 48". (Lath is also made  $\frac{5}{16}$ " or  $\frac{1}{2}$ " thick and also 32" in length. The  $\frac{1}{2}$ " thickness is recommended when spacing of supports is 24" o.c.).
- d. *Installation:* If the Standard Specifications for Lathing and Furring has been made a part of the specifications by reference, there is no need to describe the method of installation. However, if the writer wants to have the information readily available, the following should be included:

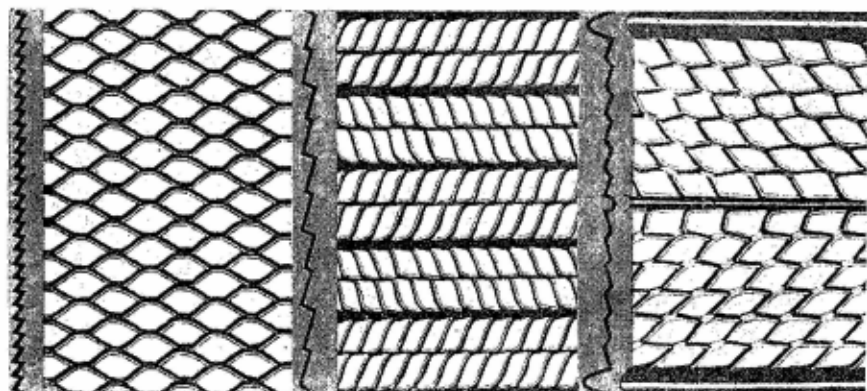
"Gypsum lath shall be secured to each wood support with 1  $\frac{1}{8}$ " No. 13 gauge blued nails with  $\frac{3}{8}$ " heads spaced not over 4" o.c. Joints shall be staggered and not tightly butted. Lath shall be applied with the long dimension at right angles to the wood supports."

### 21-5 FIBER INSULATING LATH

Fiber insulating lath, used at one time as a plaster base, is no longer used because of its dimensional instability.

### 21-6 METAL LATH

- a. Metal lath made by cutting slits in sheets of metal and then expanding the sheets is called *expanded metal lath*. This lath is often strengthened with flat ribs,  $\frac{3}{8}$ " ribs, rod stiffeners or V-stiffeners. Metal lath made by stamping sheets of metal is known as *sheet metal lath*.
- b. *Use*: Since metal lath is usually more expensive than the gypsum lath, it is seldom used throughout a frame residence, but it is often specified as a backing for portland cement plaster. In fireproof and semifireproof construction it is often specified wherever lath is required.
- c. *Type* (Figure 21-1): Expanded metal lath may be flat, flat rib or  $\frac{3}{8}$ " rib. It should be mentioned in the specifications that the metal lath shall be made of copper-bearing steel, coated with rust-inhibitive paint after cutting or cut from zinc-coated sheets. The minimum weight in lbs. per sq. yd. of the metal lath should be given. In a wood frame building with stud and joist spacing not exceeding 16", flat expanded metal lath weighing not less than 3.4 lbs. per sq. yd. or flat rib weighing not less than 2.75 lbs. per sq. yd. is often specified. Other weights and types for various spacings may be selected from Table 21-1.
- d. *Sheet Metal Lath* is seldom used. When used it is specified to be made of copper-bearing steel, coated with rust-inhibitive paint after cutting or cut from zinc-coated sheets. The minimum weight for sheet metal lath is 4.5 lbs. per sq. yd. for stud or joist spacing up to 24" o.c.



Flat Expanded  
Metal Lath

Flat Rib Expanded  
Metal Lath

$\frac{3}{8}$ " Rib Expanded  
Metal Lath

FIG. 21-1 EXPANDED METAL LATH (Courtesy Penn Metal Company, Inc., N. Y. C.)

TABLE 21-1. TYPES AND WEIGHTS OF METAL LATH, WIRE LATH, AND WIRE FABRIC AND SPACING, CENTER TO CENTER OF SUPPORTS.<sup>a</sup>

Type of Lath	Minimum Weight of Lath, lb. per sq. yd.	Maximum Allowable Spacing of Supports, in.				
		Vertical Supports			Horizontal Support:	
		Wood	Metal		Wood or Concrete	Metal
			Solid Partitions	Others		
Diamond mesh (flat expanded) metal lath	2.5	16	16	12	0	0
	3.4	16	16	16	16	13½
Flat rib expanded metal lath	2.75	16	16	16	16	12
	3.4	19	24	19	19	19
¾-in. rib expanded metal lath <sup>b</sup>	3.4	24	..	24	24	19
	4.0	24	..	24	24	24
Sheet metal lath	4.5	24	..	24	24	24
Wire lath	2.48	16	16	16	13½	13½
V-stiffened wire lath	3.3	24	24	24	19	19
Wire fabric	<sup>c</sup>	16	0	16	16	16

<sup>a</sup> Lath may be used on any spacings, center to center, up to the maximum shown for each type and weight.

<sup>b</sup> Rod-stiffened or V-stiffened diamond mesh (flat expanded) metal lath of equal rigidity and weight is permissible on the same spacings as ¾-in. rib metal lath.

<sup>c</sup> Paper-backed wire fabric, No. 16 gauge wire, 2 by 2-in. mesh, with stiffener.

Source: American Standards Association, ASA No.: A42.4-1950.

- e. *Installation:* If the Standard Specification for Lathing and Furring has been made a part of the specifications by reference, there is no need to describe the method of installation unless the writer wants the information readily available. Then the following brief description should be included:

"Metal lath shall be attached not more than 6" o.c. with barbed roofing nails to horizontal wood supports and with common nails or staples to vertical wood supports. Penetration of nails or staples shall be at least 1⅜" for horizontal supports and ¾" for vertical supports. Lath shall be lapped at sides ½" or by nesting and 1" at the ends. Side laps shall be secured to supports and tied between supports not to exceed 9" o.c. Lath shall be bent around all corners and carried to support on abutting surface."

## 21-7 WIRE LATH

- a. Wire lath is made by weaving wires into specified meshes. Wire lath is also V-stiffened to give additional strength and rigidity where indicated.
- b. *Use:* Wire lath is sometimes specified as an option for or in lieu of expanded metal lath.
- c. *Type:* Wire lath and V-stiffened wire lath are usually specified as follows:
  - 1. "*Wire Lath* shall be not lighter than No. 19 W & M\* Gauge wire,  $2\frac{1}{2}$  meshes per inch, coated with zinc or rust-inhibitive paint. Wire lath shall weigh not less than 2.48 lbs. per sq. yd. for wood stud spacing not exceeding 16" and for wood joist spacing not exceeding  $13\frac{1}{2}$ ".
  - 2. "*V-Stiffened Lath* shall be not lighter than No. 20 W & M Gauge wire  $2\frac{1}{2}$  meshes per inch with No. 24 U. S. gauge V-rib stiffeners spaced not to exceed 8" o.c. coated with zinc or rust-inhibitive paint. V-Stiffened wire lath shall weigh not less than 3.3 lbs. per sq. yd. for wood stud spacing not exceeding 24" o.c. and wood joist spacing not exceeding 19" o.c."
- d. *Installation:* It may be stated that the installation shall be in accordance with ASA No. A42.4 Standard Specifications for Lathing and Furring or it may be mentioned that the installation shall be the same as specified above for expanded metal lath.

## 21-8 PAPER-BACKED WIRE FABRIC

- a. Paper-backed wire fabric is made by wires interwoven with a paper backing and welded into a mesh.
- b. *Use:* Paper-backed wire fabric is sometimes specified when plaster is to be sprayed on.
- c. *Type:* Paper-backed wire fabric should be not lighter than No. 16 W & M Gauge, zinc-coated wire, 2" x 2" mesh, with stiffened ribs not to exceed 5" o.c. and absorptive paper backing securely attached to metal by not less than No. 17 W & M Gauge stitch wires 2" o.c. in a manner to provide full embedment of at least  $\frac{1}{8}$ " of plaster for at least  $\frac{1}{2}$  of the total length of the strands and  $\frac{1}{2}$  of the total weight of the metal. The fabric should provide a mechanical bond and continuous metallic reinforcement in both directions for plaster.
- d. *Installation:* It may be stated that the installation shall be in accordance with ASA No. A42.4 Standard Specifications for Lathing and Furring or it may be mentioned that the installation shall be the same as specified above for expanded metal lath.

\* Washburn and Moen or American Steel wire gauge.

## 21-9 PLASTERING ACCESSORIES

- a. For the proper installation of plaster certain metal plastering accessories are required. These accessories include metal bases, metal window trim and metal screeds and the following items which are usually specified for residential work.
- b. *Corner Beads* should be specified to be installed on all external corners to be plastered. The corner beads serve as a permanent protection for the corners and during the plastering operation they act as screeds. Corner beads are generally specified to be formed of No. 26 U. S. Standard Gauge galvanized steel, to have standard small nose and not less than  $1\frac{1}{2}$ " (or  $2\frac{1}{2}$ ") plain wing.
  1. For hospitals and other public buildings bullnose corner beads are often specified. These are usually  $\frac{3}{4}$ ", 1" or  $1\frac{1}{2}$ " radius.
  2. Corner beads may be specified to have not less than  $2\frac{1}{2}$ " expanded metal wings instead of plain wings. The expanded metal wing gives more surface for engaging the plaster and is the best to use except where metal lath is the base receiving the plaster.
- c. *Corner Reinforcing Strips*, sometimes referred to as *Cornerites*, should be specified to be installed in all internal corners of plaster work (where cracks are most likely to occur). Corner reinforcing strips are usually specified to be of painted or galvanized expanded metal 2" x 2" (or 3" x 3") formed of No. 28 U. S. Standard Gauge steel sheet.
- d. *Strip Lath* should be specified to be installed over joints between materials which cannot be bonded together, whose surfaces to be plastered lie in the same plane (as between gypsum lath and masonry surfaces). It is also specified to be installed over corners of window and door frames. Strip lath is usually specified to be painted or galvanized expanded metal at least 4" wide (or 6" wide) and formed of No. 28 U. S. Standard Gauge steel sheet.
- e. *Metal Casing* should be specified to be installed where plaster stops and the backing continues as the finish and where plaster abuts another finish material. Metal casings are generally specified to be of type indicated on the drawings made of No. 24 (or No. 22) U. S. Standard Gauge galvanized steel with solid wing not less than  $1\frac{1}{8}$ " (or expanded metal wing not less than 3").
- f. *Flush Access Doors* are sometimes specified to be installed in walls back of tubs and showers to provide access to the plumbing pipes. These doors are specified to be  $14\frac{1}{2}$ " x  $18\frac{1}{2}$ " constructed of 14 U. S. Standard Gauge steel door and 18 U. S. Standard Gauge steel frame with perforated (or expanded metal) flange for plaster key, complete with latch,



anchor and hinges. Flush access doors should be given manufacturer's standard gray prime coat.

## 21-10 PLASTERING MATERIALS

- a. The principal materials used for plastering may be specified by brand names or, more easily, by reference to Standard Specifications.
- b. *Lime Putty* is often specified to be made of hydrated lime for small jobs. Since it requires more time and space to make putty of quicklime, it is not often specified except for large work on a large site and then it is usually included as an optional choice of the Contractor.
  1. *Hydrated Lime* should meet the requirements of ASTM Spec. C206 (Fed. Spec. SS-L-351, *Type F*). Hydrated lime should be mixed with water, screened through a sieve. If required by the manufacturer the lime should be allowed to soak for 24 hours before use.
  2. *Quicklime* should meet the requirements of ASTM Spec. C5 (Fed. Spec. SS-Q-351, *Type C or M*). It should be thoroughly slaked, run through a No. 8 sieve made of 16 gauge wire, and allowed to stand at least two weeks before use.
- c. *Gypsum Plaster* is often specified by requiring it to meet the requirements of ASTM Spec. C28 (Fed. Spec. SS-P-402) which covers most of the types required. Gypsum plaster is made by heating gypsum, a native rock composed principally of calcium sulfate crystallized with about 20% of water. The resulting material is known as *Calcined Gypsum*, *Plaster of Paris* or *White Plaster*. Gypsum plaster is sold in powder form in bags under the following commercial names:
  1. *Gypsum Gauging Plaster*, a plaster of specially ground calcined gypsum for use in finish coat with addition of lime putty.
  2. *Prepared Gypsum Trowel Finish*, a gauging plaster mill-mixed with lime for use in finish coat without addition of lime putty.
  3. *Neat Gypsum Plaster*, a calcined gypsum to which is added hydrated lime and a retarder for use in scratch and brown coats with the addition of sand. It is sold as *unfibred neat gypsum plaster*, or, when either hair or sisal fiber is added, it is sold as *fibred neat gypsum plaster*. The term "neat" as applied to gypsum means that the material does not contain aggregate. Aggregate must be added on the job.
  4. *Wood Fibred Plaster*, a neat gypsum plaster mill-mixed with wood fibers for use in scratch or brown coat without the addition of sand. This plaster is used for patch work and in localities where a good grade of sand is not available.
  5. *Sanded Plaster*, a neat gypsum plaster mill-mixed with sand, for use

as scratch or brown coat without addition of sand. This plaster, also, is used for patch work and in localities where a good grade of sand is not available.

6. *Concrete Bond Gypsum Plaster*, a specially prepared gypsum plaster for base coat application to concrete surfaces to give maximum bond. Water only is added in mixing on the job.
- d. *Gypsum Moulding Plaster*, if used, is often specified to meet the requirements of ASTM Spec. C59. Moulding plaster is a plaster made from select gypsum rock for ornamental plaster work of all kinds and as a quick-setting gauging plaster.
- e. *Keene's Cement* is often specified to meet the requirements of ASTM Spec. C61 (Fed. Spec. SS-C-161, Type II for finish). Keene's cement is an extremely hard gypsum plaster produced by burning select gypsum rock at many degrees higher than normally used. This cement is used where a less water absorbent and much harder plaster is desired.
- f. *Portland Cement* as mentioned before is often specified to meet the requirements of ASTM Spec. C150, *Type I*. Portland cement is made by heating natural or artificial mixtures of limestone and clay to an extremely high temperature. It is sold in bags holding 94 lbs. each. Portland cement, mixed with lime putty and sand, is used as a hard, sand finish, fire-retarding, nonwater-absorbent plaster and for all coats of stucco.
- g. *Sand* should meet the requirements of ASTM Spec. C35.
- h. *Vermiculite* is a lightweight material made by expanding a certain type of mica. When used as an aggregate for plaster it should weigh not less than  $7\frac{1}{2}$  nor more than 10 lbs. per cu. ft. and particles should be graded in size as required for sand for use in plaster by ASTM Spec. C35.
- i. *Perlite* is a lightweight material made by expanding volcanic rock, and when used as an aggregate for plaster should weigh not less than  $7\frac{1}{2}$  nor more than 15 lbs. per cu. ft. Particles should be graded in size as required for sand for use in plaster by ASTM Spec. C35 except that the minimum percentage retained on a No. 100 sieve may be 90% instead of 95%.

## 21-11 PLASTER MIXES

- a. Under the heading of *Plaster Mixes* it might be mentioned that partially hardened material shall not be retempered or used. On small jobs either hand or mechanical mixing is permitted. Proportions, except as otherwise noted, are by weight (one 100-lb. bag equals 1 part gypsum plaster, and 7 No. 2 shovelfuls equal 1 part damp loose sand):
- b. "*Scratch Coat (1st coat)* on surfaces not otherwise specified shall be of:

- 1 part gypsum neat plaster (fibered or unfibered)
- 2 parts sand

Scratch coat on monolithic concrete surfaces shall be of concrete bonding plaster.

Base coat for all two-coat work shall be of:

- 1 part gypsum neat plaster
- 2½ parts sand."

- c. "*Brown Coat (2nd coat)* in all three-coat work and Scratch Coat on masonry shall be of:

- 1 part gypsum neat plaster
- 3 parts sand."

- d. *Finish Coat*: If a smooth steel trowel finish is desired, a lime putty and gypsum gauging plaster finish is usually specified as per 1 below. If a sand-textured, wood float finish is desired, a neat gypsum and sand finish is usually specified as per 2 below.

1. "*Lime Putty and Gypsum Gauging Plaster Finish* shall be mixed approximately 3 parts of lime putty to 1 part of gauging plaster by volume, and shall be applied to all surfaces where the Finish Schedule calls for Plaster."

Actual proportions are left to the discretion of the Plasterer. The Contractor may be given the option of using prepared gypsum trowel finish plaster in lieu of the lime putty and gypsum gauging plaster.

2. "*Neat Gypsum and Sand Finish* shall be applied to all surfaces where the Finish Schedule calls for Plaster and shall be of:

- 1 part gypsum neat unfibered plaster
- 2 parts sand passing a No. 12 sieve."

No. 16 sieve or No. 20 sieve also are specified depending on texture desired. The Contractor may be given the option of using gypsum sand float finish plaster in lieu of the above-mentioned mix.

- e. "*Keene's Cement Plaster* shall be applied to all areas where the Finish Schedule calls for Keene's Cement finish" (these areas are usually the walls and ceilings of Bath Rooms where moisture is prevalent) "and by volume shall be of:

- 1 part of lime putty
- 1½ parts of Keene's cement"

- f. "*Portland Cement Plaster* shall be applied to all areas where the Finish Schedule calls for Cement Plaster" (these areas are usually the ceiling

of Furnace Room and Garage) "and for the scratch and brown coats under Keene's Cement finish and for the scratch and brown coats to serve as a backing for all tile wainscots. Coats shall be mixed by volume as follows:

- 1 part of portland cement
- $\frac{1}{4}$  part lime putty or hydrated lime
- 3 parts sand

For scratch coat on metal lath add 1 lb. of hair or fiber per sack of cement."

#### 21-12 VERMICULITE (PERLITE) PLASTER MIXES

- a. Because of the lightweight and insulating properties of plasters made with vermiculite or perlite aggregate, it is sometimes specified in lieu of sand in the scratch coat and brown coat. Although the vermiculite or perlite aggregate may cost more than sand, it is easier to apply. Scratch coat and brown coat made with vermiculite or perlite aggregate are generally specified as follows:

- b. "*Scratch Coat (1st coat)* on surfaces not otherwise specified shall be of:

- 100 lbs. of gypsum neat plaster
- 3 cu. ft. of vermiculite (2 cu. ft. of perlite)

Base coat on all two-coat work shall be of:

- 100 lbs. of gypsum neat plaster
- $2\frac{1}{2}$  cu. ft. of vermiculite (2 cu. ft. of perlite)

- c. *Brown Coat (2nd coat)* in all three-coat work and scratch coat on masonry surfaces shall be of

- 100 lbs. of gypsum neat plaster
- 3 cu. ft. of vermiculite (2 cu. ft. of perlite)"

#### 21-13 GROUNDS

Grounds are strips of wood serving as guides for straightedge for leveling the brown coat and as a nailing strip for fastening wood trim or other finish. It should be noted under a paragraph with this heading that wood grounds are specified in the section of the specifications entitled *Rough Carpentry* (see Chapter 17).

#### 21-14 APPLICATION OF PLASTER

- a. Plaster is generally specified to be applied in three coats, and Contractor is permitted to apply the brown coat over the scratch coat before it has

hardened except when the base is of a deflecting material such as metal lath, wire lath or wire fabric. Plaster should be applied only when a 40-degree or higher temperature can be maintained. All surfaces should be cleaned and roughened where necessary before plaster is applied. Masonry surfaces should be moistened before plaster is applied.

- b. *Scratch Coat* is specified to be applied with sufficient force to form a good key or bond with the surface receiving it. This coat, when allowed to harden, should be scratched with a suitable tool, making V-shaped scratches approximately  $\frac{1}{8}$ " deep by 1" apart.
- c. *Brown Coat* is specified to be applied over scratch coat, rodged and darbied to produce a true plane surface, flush with the grounds. Brown coat should be left rough, ready for the finish coat.
- d. *Application of Finish Coat*: Finish coat should not be applied until the brown coat is thoroughly dry. It should be spread to cover brown coat completely and there should be no noticeable joints or ridges.
  - 1. *Trowel Finish*: The finish coat should be allowed to draw for a few minutes, then troweled to a smooth, hard even surface; or
  - 2. *Float Finish*: The finish coat should be troweled with a wood float to an even sand-textured surface.
- e. *Application on Concrete Surfaces*: It is unusual to have concrete surfaces receiving plaster in a residence; but, if it occurs, the specification writer should specify the scratch coat to be of bond plaster. Where bond plaster is applied to concrete ceilings or stair soffits, no brown coat should be required and total thickness of plaster coats should be not less than  $\frac{1}{8}$ " and not more than  $\frac{3}{8}$ ".

## 21-15 STUCCO

- a. The effectiveness of stucco is largely dependent upon the proper reinforcement and proper curing of the plastic materials involved. Stucco applied over wood lath, stucco applied without waterproof backing and stucco applied against unfurred mesh is not recommended. Stucco is often specified for porch ceilings and where stucco is indicated on the elevations.
- b. *Stucco Lath* should be specified to be used as a base for all stucco except where the stucco may be applied to masonry surfaces. The stucco lath should be held at least  $\frac{3}{8}$ " away from sheathing with galvanized self-furring nails, metal furring strips or self-furring lath. The specification writer should specify the lath to be galvanized and select the type to specify from the following:
  - 1. Expanded metal lath with 1" x 2" openings weighing not less than 1.8 lbs. per sq. yd.

2. Expanded metal lath with small openings weighing not less than 3.4 lbs. per sq. yd.

All stucco lath should be paper-backed, except when applied over sheathing covered with waterproof felt.

- c. *Stucco Mixes* are usually specified to be mixed by volume as follows:

1. *Scratch Coat*:

1 part of portland cement  
3 parts sand  
10% lime putty

2. *Brown Coat*:

Same as Scratch Coat

3. *Finish Coat*:

1 part white portland cement  
3 parts of sand  
10% lime putty

- d. *Application of Stucco* may be specified as follows:

1. "Scratch Coat shall be approximately  $\frac{1}{4}$ " thick applied with pressure and heavily cross scratched. Cure with controlled spraying until brown coat is applied. This coat may be omitted when stucco is applied directly to masonry surface."
2. "Brown Coat shall be approximately  $\frac{3}{8}$ " thick. Dampen scratch coat before applying. Apply with pressure and bring to an even surface with wood float then cross scratch. Cure with controlled spraying until finish coat is applied."
3. "Finish Coat shall be approximately  $\frac{1}{4}$ " thick. Apply with wood float and bring to an even sand-textured surface. Cure for 7 days with controlled spraying."

## 21-16 DRYWALL CONSTRUCTION

- a. Many residences today are built without using lath and plaster; instead gypsum wallboard with taped joints is specified. For the best installation, two layers of  $\frac{3}{8}$ " wallboard are specified with the top layer laminated at right angles to the first layer. Most residences, however, have only one layer and such a specification could be written as follows:

- b. *Materials*

1. *Gypsum Wallboard* shall be 4 ft. wide, tapered edge, sheets,  $\frac{1}{2}$ " ( $\frac{3}{8}$ " or  $\frac{5}{8}$ ") thick as required, and shall meet the requirements of Fed. Spec. SS-W-51a and ASTM Spec. C36.

2. *Nails* shall be GWB-54 1 $\frac{5}{8}$ " (1 $\frac{3}{8}$ " or 1 $\frac{7}{8}$ ") long annular ring meeting the requirements of ASTM C380.
  3. *Joint Reinforcing* shall be perforated tape or metal-backed tape joint system.
  4. *Corner Beads* shall be standard galvanized steel, drywall corner beads.
  5. *Casing Beads* shall be standard galvanized steel, drywall casing beads, properly sized to fit the wallboard.
- c. *Installation of Wallboard*
1. The gypsum wallboard shall be applied first to the ceilings and then to the sidewalls; wallboards of maximum practical length shall be used to reduce end joints. Edges and ends of boards shall be brought into contact but not forced into place. End joints shall be staggered. Joints on opposite sides of a partition shall not occur on the same stud member.
  2. *Nails* shall be spaced not less than  $\frac{3}{8}$ " from ends and edges of wallboard. Nails shall be spaced not more than 7" apart on ceilings nor more than 8" apart on sidewalls. Use 5d nails for  $\frac{1}{2}$ " wallboard and 6d nails for  $\frac{5}{8}$ " wallboard. The wallboard shall be held in firm contact with the nailing member while nails are being driven. Nailheads shall be dimpled slightly below the surface of the wallboard with the final hammer blow, care being taken not to break the paper face.
  3. *Joints and Internal Angles* shall be finished using the tape joint system in accordance with the manufacturer's instructions. Finish joints, nail dimples, corners and edges using the three-coat cement and tape system. Allow 24 hours for drying between applications of cement. Sand the cement after each coat is dry to a smooth surface, effectively concealing the joints or nails.
  4. *Corner Beads* shall be applied to all external corners.
  5. *Casing Beads* shall be applied around all wall or ceiling openings.
  6. The gypsum wallboard installation shall be done by an approved experienced drywall applicator normally engaged in this trade.

## CHAPTER 22

### Marble and Tile

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#### 22-1 GENERAL

- a. The length of the *Marble and Tile* section can be reduced considerably by stating that all work shall meet the requirements of American Standard Specifications A108.1, A108.2 and A108.3, latest editions, for Glazed Ceramic Wall Tile, Ceramic Mosaic Tile and Quarry Tile and Pavers as sponsored by the Tile Council of America, Inc., insofar as any portion is applicable to the building.
- b. *Samples:* Contractor should be required to furnish samples of each type of tile and marble specified to the Architect for approval.

#### 22-2 MORTAR MATERIALS

- a. Mortar materials are well covered by the basic specifications mentioned above and the specification writer may elect not to specify the following unless he wishes it to be in the specification for job reference.
- b. *Mortar Materials* should be the same as specified in the section entitled *Masonry*, except sand for pointing mortars should be graded from No. 30 to No. 100, and coarse aggregate, if used, should be graded from  $\frac{1}{4}$ " to 1".

#### 22-3 MORTAR MIXES

- a. Mortar mixes are clearly described in the basic specifications referred to above, and mention of the following might be omitted from the specifications:
- b. *Setting Bed Mortar:*
  - 1 part portland cement
  - $\frac{1}{10}$  part lime putty
  - 5 to 6 parts sand



c. *Mortar for Wall Tile:*

- 1 part portland cement
- $\frac{1}{2}$  part lime putty
- 4 to 5 parts sand

d. *Mortar for Shower Receptors:*

- 1 part portland cement
- $3\frac{1}{2}$  to 4 parts sand

e. *Grout:* Neat white portland cement and lime putty mixed with water to consistency of thick cream.

f. *Pointing Mortar for Joints:*

- 1 part portland cement
- $\frac{1}{3}$  part lime putty
- 2 parts sand

## 22-4 TILE

- a. Tile should meet the requirements of the Simplified Practice Recommendation SPR61, Clay Tiles for Floors and Walls, issued by the United States Department of Commerce and Fed. Spec. SS-T-308.
- b. *Grade:* Tile is generally specified to be *Standard Grade*. The other grade permitting chips, sand holes and other imperfections is known as *Seconds*. It is sometimes required that a certificate of grade in the form adopted by the Tile Manufacturers Association shall be furnished the Architect before the tile work is started.
- c. *Trimmers:* It should be specified that the Contractor shall furnish all necessary trimmers including angles, stops and returns.

## 22-5 QUARRY TILE

- a. Quarry tile are unglazed tile made from natural clay by the plastic process and are semivitreous or vitreous, usually buff, gray, brown or red in color.
- b. *Use:* The specification writer should mention the areas where quarry tile flooring will be required. In residential work these areas are usually Porch, Terrace, Entrance Stoop or Entrance Vestibule.
- c. *Type:* Quarry tile should have square edges and scored backs, and color should be selected from the following:

Plain buff	Fire flashed buff
Plain gray	Fire flashed gray
Plain brown	Fire flashed brown
Plain red	Fire flashed red

Full Range

- d. Size of the quarry tile required should be given and the sizes usually specified for residential work are 6" x 6" x  $\frac{1}{2}$ ". Other sizes are:

$2\frac{3}{4}$ " x  $2\frac{3}{4}$ " x  $\frac{1}{2}$ "  
 $2\frac{3}{4}$ " x 6" x  $\frac{1}{2}$ "  
 4" x 4" x  $\frac{1}{2}$ "  
 8" x  $3\frac{7}{8}$ " x  $\frac{3}{4}$ "  
 8" x 8" x  $\frac{3}{4}$ "  
 9" x 9" x  $\frac{3}{4}$ " (or 1")

- e. *Installation:* If an oblong tile has been selected, it should be stated whether the tile is to be laid in herringbone or basket weave pattern. Tile squares usually are specified to be laid with straight joints  $\frac{1}{4}$ " ( $\frac{3}{8}$ " or  $\frac{1}{2}$ ") wide. Mortar setting bed should be from 1" to  $1\frac{1}{4}$ " thick.

## 22-6 FLOOR TILE

- a. The most common type of tile used for floors of Bath Rooms in residences is *ceramic mosaic* tile, a term used by the industry for tile  $\frac{1}{4}$ " to  $\frac{3}{8}$ " in thickness by  $2\frac{3}{16}$ " for the longest dimension. This type of tile is made by the dust-pressed or plastic process and is vitreous or semivitreous. Pieces of this type of tile are often mounted on paper sheets or other special type of mounting to facilitate laying.
- b. *Use:* It is usually sufficient to say that floor tile shall be installed in all areas where the Finish Schedule on the drawings calls for tile. These areas are usually Bath Rooms, Toilets and Powder Rooms and sometimes Kitchens.
- c. *Type* specified is usually dust-pressed, unglazed, vitreous, square edge (cushion edge) porcelain type (natural clay type) ceramic mosaic tile mounted on paper sheets or other special type of mounting. Colors are often specified to be selected by the Architect.
- d. *Pattern:* The specification writer may wish to note the pattern desired. As recommended by the Modular Building Standards Association several manufacturers are now marketing ceramic mosaic tile planned on a 1" module consisting of 1" x 1", 1" x 2" and 2" x 2" sizes including joints. It will encourage the production of modular tile to select patterns made up of these sizes.
- e. *Preparation for Setting Bed over Wood Construction* (Figure 22-1): Where tile floors are to be laid over wood subflooring, first require the Contractor to lay 15 lbs. asphalt- or tar-saturated felt lapping sheets at least 3" and mop entire surface with hot asphalt or coal tar pitch. Over this, require the Contractor to install as reinforcement expanded metal lath with large  $1\frac{1}{4}$ " x 3" diamond-mesh painted (or unpainted) ex-

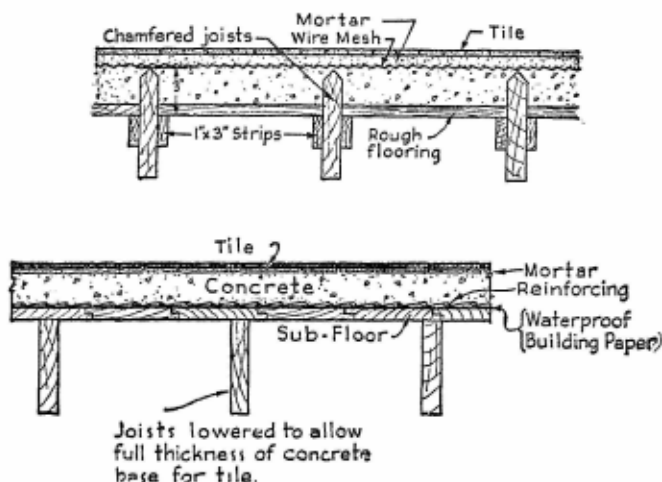


Fig. 22-1 PREPARATION FOR TILE FLOOR. Chamfered joists shown in upper figure are commonly employed. Dropped joists shown in lower figure are to be preferred.

panded metal lath weighing not less than 1.8 lbs. (3.6 lbs.) per square yard (or welded wire fabric 6 x 6 10/10).

- f. *Setting Bed* for floor tile should be not less than  $1\frac{1}{4}$ " over wood construction and not less than  $\frac{3}{4}$ " over concrete.
- g. *Installation:* Portland cement should be dusted over surface of mortar setting bed and ceramic mosaic sheets laid at regular intervals and pressed down to an even surface. Joints between tile sheets shall be the same as the joints between the tile on the sheets. After the bed has set the tile should be washed and grouted.

## 22-7 TILE BASE (Figure 22-2)

- a. Tile base is generally used in connection with tile wainscoting. If used without wall tile, it should be specified to have round top and cove base 6" x 6" or 6" x 4".
- b. *Use:* Tile base should be installed in all areas where the Finish Schedule calls for tile.
- c. *Type:* Tile base should have cove base and should match wall tile in type and finish; color to be selected by the Architect.
- d. *Size:* Tile base is usually specified to be  $4\frac{1}{4}$ " x  $4\frac{1}{2}$ " or  $4\frac{1}{4}$ " x 5". Other sizes are: 6" x 2", 6" x 6" and 6" x  $3\frac{3}{4}$ ".
- e. *Installation:* Tile base should line with the wall tile and should be backed full with mortar.

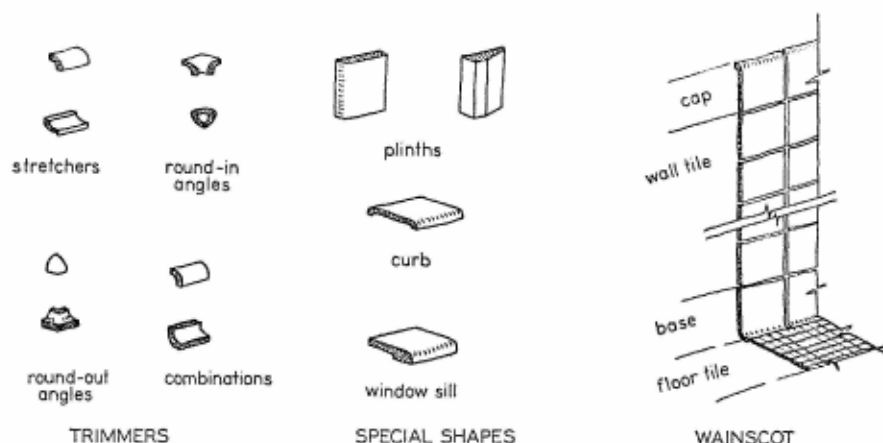


FIG. 22-2 CERAMIC TILE

### 22-8 WALL TILE (Figure 22-2)

- a. Wall tile generally used in residences is a glazed tile, nonvitreous type made by the plastic process.
- b. *Use:* Wall tile should be installed in all areas where Finish Schedule on the drawings calls for tile (usually for wainscots in Baths, Toilets, Powder Rooms and sometimes in Kitchens).
- c. *Type:* Wall tile may be specified as nonvitreous ceramic cushion-edge (square-edge) matt-glazed (bright-glazed) tile; color to be selected by the Architect. External corners should be rounded and internal corners should be square (rounded).
- d. *Size:* Tile is generally  $4\frac{1}{4}" \times 4\frac{1}{4}"$ . Other sizes sometimes specified are  $3" \times 3"$ ,  $6" \times 6"$ ,  $6" \times 4\frac{1}{4}"$ ,  $6" \times 3"$ ,  $8\frac{1}{2}" \times 4\frac{1}{4}"$  and  $9" \times 6"$ . It is an expensive operation for a manufacturer to tool up for production of modular tile, but some day in the near future wall tile may change from the traditional  $4\frac{1}{4}" \times 4\frac{1}{4}"$  to  $4" \times 4"$  size including joints to conform to the 4" grid system promoted by the Modular Standards Association.
- e. *Wainscots* should be approximately 6' 0" high from the floor where bath tubs and showers occur and approximately 4' 0" high on the remaining walls.
- f. *Installation:* Over scratch coat backing installed by others, Tile Contractor should apply a mortar setting bed, then lay tile to required lines with  $\frac{1}{16}"$  joints. After tile has set, joints should be grouted.

### 22-9 WAINSCOT CAPS (Figure 22-2)

- a. *Use:* Wainscot caps are used to finish the top of all tile wainscots.
- b. *Type:* Wainscot caps are usually specified to have bull-nose tops and to

match the wall tile in type and finish; color to be selected by the Architect.

- c. *Size:* Wainscot caps are often specified to be  $4\frac{1}{4}" \times 4\frac{1}{4}"$  or  $2" \times 6"$ . other sizes are  $6" \times 3\frac{3}{4}"$ ,  $3" \times 3\frac{3}{4}"$  and  $6" \times 6"$ .

#### 22-10 SPECIAL SHAPES (Figure 22-2)

Special shapes of tile are often required, such as plinths to receive the ends of door trim, cap pieces for curbs into shower compartment and window sills. Note should be made of these in specifications.

#### 22-11 INSTALLATION OF TILE

- a. Installation of tile is thoroughly covered by the basic specifications mentioned in the first paragraph of this chapter and the following need not be included unless desired for reference:
- b. *"Installation of Tile:* All tile shall be brought to level and straight lines, all caps and bases shall be backed full with mortar. All tile except non-absorbent tiles and those mounted on paper shall be thoroughly soaked in clean water before being set."

#### 22-12 ACCESSORIES

It should be written under this heading that the Contractor shall install all Bath Room Accessories including medicine cabinets, robe hooks, soap dishes, toilet paper holders, towel bars, grab bars, tumbler holders, and mention a sum to be allowed for the purchase of these accessories.

#### 22-13 MARBLE HEARTHS AND FACINGS

- a. If marble hearths and facings are to be used for fireplaces, they are usually specified to be installed by the Tile Contractor and a lump sum mentioned as an allowance for their purchase. Requirements for installation may be specified as follows:
- b. *"Hearths* shall be  $1\frac{1}{4}"$  thick and shall be laid in setting bed of mortar same as specified for tile work. Joints shall be  $\frac{1}{16}"$  thick and grouted with water and neat cement."
- c. *"Facings* shall be  $\frac{7}{8}"$  thick and shall be set by spotting with Plaster of Paris and the use of concealed 8 B and W Gauge brass or hard copper anchors. Joints shall be  $\frac{1}{16}"$  thick and fully buttered with Plaster of Paris as slabs are set."

#### 22-14 CLEANING

The specification writer should mention that upon completion of the work all marble and tile shall be thoroughly cleaned and all mortar stains removed. Acid solution shall not be used for cleaning marble or glazed tile.

## CHAPTER 23

# Flooring

---

### 23-1 GENERAL

- a. The types of flooring for different areas are generally indicated in *Finish Schedule*. There are two general paragraphs which should appear near the beginning of a section devoted to specifying flooring; they should be similar to the following:
- b. "Samples of each type of resilient flooring, base and edging strip specified shall be submitted to the Architect for approval."
- c. "Underfloor Condition: Wood underfloors shall be sanded before application of resilient flooring. All underfloors shall be clean, dry and smooth before application of flooring. Concrete floors shall be tested for dryness before tile is laid."

### 23-2 WOOD FLOORING

- a. In some localities the Subcontractors handling resilient flooring are also engaged in the furnishing, laying, sanding and finishing of wood flooring; this is a good reason to include wood flooring in the same specification section covering asphalt tile, linoleum, rubber tile and the like. It is customary to lay wood flooring over wood subflooring which has been laid under the requirements of *Rough Carpentry* section of the specifications. Both hardwood and softwood are used in the manufacture of flooring.
- b. *Hardwood Flooring*: By virtue of its strength and hardness and its capacity to wear well under abrasion and take an excellent transparent finish, hardwood flooring is generally specified for areas not to be covered with resilient flooring. Since it is abundant and suitable, Oak is the hardwood most generally used for the manufacture of flooring, and maple is next. Beech and Birch are used sparingly as flooring.
- c. It should be noted here that the word "hardwood" is the name used by the lumber industry for all woods cut from trees with broad leaves and

is not based on the actual hardness of the wood. A few "hardwoods" are actually softer than some of the "softwoods."

- d. *Softwood Flooring* compared to hardwood does not wear well under abrasion and the flat grains have a tendency to splinter. For these reasons softwood flooring is principally used for areas to be covered with resilient flooring. When softwood flooring is specified for the finish floor, not to be covered with another material, the vertical grained type should be required.
- e. Due to availability, Southern Pine and Douglas Fir occupy the first place in the woods used for softwood flooring. Other softwoods employed for flooring in the localities where they grow include Cedar, Redwood, Western Hemlock and Southern Cypress.
- f. *Thickness* (Table 23-2): Wood flooring is made in several thicknesses. The  $2\frac{5}{32}$ " thickness is most commonly used for general purposes and new construction. The  $3\frac{3}{32}$ " thickness with its additional  $\frac{1}{4}$ " wearing surface is generally used where floor will be subjected to extraordinary wear. The  $\frac{3}{8}$ " thickness is principally used for laying over old floors. All other thicknesses are manufactured for special purposes. Jointed flooring, sometimes called square-edge flooring (without T&G), is also made and has the advantage of easy replacement in industrial floors.

### 23-3 OAK FLOORING

- a. Commercially Oak is divided into two classifications: (1) Red Oak and (2) White Oak. As the names imply, the Red Oak is darker than the White Oak, but color is not considered in the grading rules of Oak flooring. Red Oak is more plentiful and therefore usually lower in price, yet is as durable as White Oak.
- b. *Use*: Oak flooring should be laid in all areas indicated by Finish Schedule to receive wood flooring.

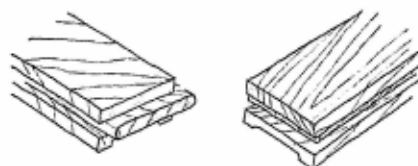


FIG. 23-1 END MATCHED FLOORING

- c. *Type*: Flooring is usually specified to be T&G, EM (see Figure 23-1), Quarter Sawed (Plain Sawed) Red and White Oak (Red Oak or White Oak) and *Clear Grade* (for other grades see Table 23-1) Oak flooring as established

by the Grading Rules of the Oak Flooring Manufacturers' Association. The best pieces of flooring should be selected from the bundles and laid in the Living and Dining areas.

- d. *Size*: Oak flooring generally is  $2\frac{5}{32}$ " x  $2\frac{1}{4}$ ". (For other sizes see Table 23-2.)

TABLE 23-1. GRADES OF WOOD FLOORING

<i>Flooring</i>	<i>Association</i>	<i>Special Grade Selected for Color</i>	<i>This Grade Practically Clear</i>	<i>This Grade Permits Small Defects</i>	<i>This Grade Permits Larger Defects</i>	<i>Other Lower Grades</i>
Quarter Sawed Oak	NOFMA	—	Clear	Select	No. 1 Com.	—
Plain Sawed Oak	NOFMA	—	Clear	Select	No. 1 Com.	No. 2 Com. or 1¼' Shorts
Hard Maple	MFMA	Select First Grade Light or Select First Grade Amber	First	Second	Third	Fourth
Hard Maple	NOFMA	First Grade White	First	Second	Third	—
Beech and Birch	MFMA	Red Clear	First	Second	Third	—
Beech and Birch	NOFMA	First Grade Red	First	Second	Third	—
Edge Grain Southern Pine	SPA	—	—	B & Better	C	D or No. 2
Flat Grain Southern Pine	SPA	—	—	B & Better	C	D or No. 2
Edge Grain Douglas Fir and Western Hemlock	WCLA	—	B & Better	C	D	—
Flat Grain Douglas Fir and Western Hemlock	WCLA	—	—	C & Better	D Mixed Grain	E Mixed Grain
Western Red Cedar (Recommended for exterior uses)	WCLA	—	B & Better	C	—	—

## ASSOCIATIONS

NOFMA	National Oak Flooring Manufacturers' Association, Memphis, Tennessee
MFMA	Maple Flooring Manufacturers' Association, Chicago, Illinois
SPA	Southern Pine Association, New Orleans, Louisiana
WCLA	West Coast Lumbermans' Association, Portland, Oregon



TABLE 23-2. SIZES OF WOOD FLOORING IN INCHES

Oak	Maple, Beech and Birch	Pine	Fir and Hemlock
25/32 x 1½	25/32 x 1½	25/32 x 2¾	25/32 x 2¾
25/32 x 2	25/32 x 2	25/32 x 3¼	25/32 x 3¼
25/32 x 2¼	25/32 x 2¼		25/32 x 5¼ <sub>10</sub>
25/32 x 3¼	25/32 x 3¼		
¾ x 1½	¾ x 1½		
¾ x 2	¾ x 2		
½ x 1½	½ x 1½		
½ x 2	½ x 2		
	33/32 x 2		
	33/32 x 2¼		
	33/32 x 3¼		

- e. *Shoe Moulding* profile should be shown on the drawings and be of Oak to match flooring.

#### 23-4 MAPLE, BEECH AND BIRCH FLOORING

- a. Maple is best known for its use on floors receiving a great deal of abuse such as for factories, warehouses and skating rink floors. The best grades of Maple make a handsome floor and are used for residences; Beech and Birch are occasionally used.
- b. *Use:* Maple, Beech or Birch flooring is generally used in lieu of and not in addition to Oak, and the sentence covering its use should read:

“Maple (Beech or Birch) flooring shall be laid in all areas indicated by the Finish Schedule to receive wood flooring.”

- c. *Type:* This flooring is usually specified to be T&G, EM, *First Grade* (for other grades see Table 23-1), Northern Hard Maple (Northern Beech or Northern Birch) flooring as established by the Grading Rules of the Maple Flooring Manufacturers Association (National Oak Flooring Manufacturers' Association). Best pieces of flooring may be specified for the prominent areas as mentioned above for Oak flooring.
- d. *Size:* Maple (Beech or Birch) flooring should be 2½<sub>32</sub>" x 2¼". (For other sizes see Table 23-2.)
- e. *Shoe Moulding* should be of profile shown on drawings and of lumber to match flooring.

#### 23-5 PINE, FIR AND HEMLOCK FLOORING

- a. The paragraph describing Pine, Fir or Hemlock flooring could be written as follows:
- b. *Use:* “In all areas to receive resilient type flooring, Pine (Fir or Hemlock) shall be laid as underfloor.”
- c. *Type:* “Flooring shall be T&G, hollowed back, plain-end (or EM) C Grade” (for other grades see Table 23-1) “Flat Grain (Edge Grain)

Southern Pine (Douglas Fir or Western Hemlock) as established by the Grading Rules of the Southern Pine Association (West Coast Lumberman's Association)."

- d. *Size*: "Pine (Fir or Hemlock) flooring shall be  $2\frac{5}{32}$ " x  $3\frac{1}{4}$ ." (See Table 23-2 for other sizes.)
- e. *Shoe Moulding* shall be of profile shown on drawings and of lumber to match flooring."

### 23-6 BUILDING PAPER AND FELTS

- a. Building paper or felt should be specified to be laid with joints lapped 4" between the wood subflooring and finish wood flooring to act as a sound deadener, to prevent squeaks and to keep moisture away from the bottom of finish flooring. A lining felt should be specified to be installed between the wood flooring and resilient flooring to help prevent joints and imperfections in the wood flooring from showing through the resilient flooring. Lining felt is not required between a concrete floor and resilient flooring.
- b. *Building Paper*: Although it is not recommended, rosin sized building paper weighing not less than 20 lbs. (25 lbs. or 30 lbs.) per roll of 500 sq. ft. for economy is sometimes specified to be laid between wood subflooring and finish wood flooring, instead of felt as described below.
- c. *Felt*: It is recommended by the wood flooring manufacturers that 15-lb. asphalt-saturated felt complying with ASTM Spec. D226 (or Fed. Spec. HH-F-191a) be specified to be laid between wood subflooring and finish wood flooring. Asphalt-saturated felt weighing not less than 30 lbs. is sometimes specified where thermal insulation is desired, such as for the floor over boiler or furnace room and where additional sound deadening is desired such as for the floors above the first floor.
- d. *Lining Felt*: It is recommended by the resilient flooring manufacturers that lining felt be installed between the finish wood flooring and the resilient flooring. This lining felt is generally specified to be of 15-lb. asphalt-saturated felt complying with ASTM Spec. D226 (or Fed. Spec. HH-F-191a), except the felt under cork tile shall be of 30-lb. felt. Lining felt is specified to be laid with butt joints and cemented with a cement recommended by the manufacturer of the resilient flooring.

### 23-7 LAYING WOOD FLOORS (Figure 23-2)

Wood flooring usually is specified to be laid at right angles to the floor joists and blind-nailed not over 10" o.c. with 8d steel cut nails, with 8d screw type case hardened nails or with flooring cleats 2" long for  $2\frac{5}{32}$ " thick flooring and with bright wire casing nails for flooring less than  $2\frac{5}{32}$ " thick. Nails should be driven in at an angle of 45 to 50 degrees and countersunk

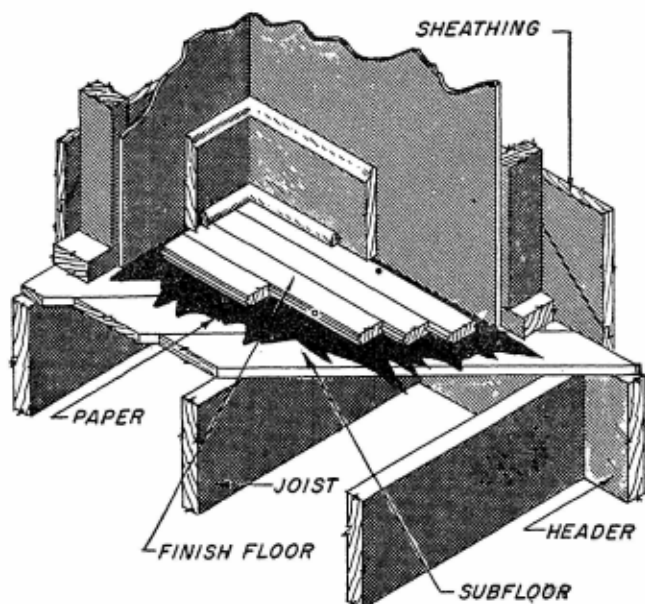


FIG. 23-2 WOOD FLOORING (From "Technique of Housing Nailing" by U. S. Forest Products Laboratory and Housing and Home Finance Agency)

with a steel set. Sometimes it is specified that the flooring is not to extend under baseboards to permit the shoe moulding to be nailed to the subfloor. Shoe moulding should be mitered at external corners and coped at internal corners and secured with finishing nails, countersunk and puttied.

#### 23-8 MATERIALS FOR FINISHING WOOD FLOORS

- a. Following are the materials generally specified for finishing wood floors and shoe mouldings:
- b. *Interior Oil Stain* is a thin liquid used either to change or modify the color of interior wood surfaces without obscuring the natural grain. It may be specified by manufacturer's brand name or by reference to Fed. Spec. TT-S-711a.
- c. *Paste Wood Filler*, a mixture of silex or ground quartz and quick-drying varnish, is used principally to fill the pores of open grain wood such as Oak (see Paragraph 24-7b). It may be specified by reference to manufacturer's brand name or by reference to Fed. Spec. TT-F-336b.
- d. *Varnish Type Floor Sealer* is used for sealing and treating interior wood and cork floors and it provides a foundation for floor varnish or wax. It may be specified by manufacturer's brand name or by reference to Fed. Spec. TT-S-176b *Class 1* for floors of high absorption rate and *Class 2* for floors of denser structure.

- e. *Shellac Varnish*: Due to the rapid drying characteristic of Shellac Varnish, Flooring Contractors prefer it as a sealer to a Varnish Type Floor Sealer. The film formed by Varnish Type Floor Sealer has more elasticity and is considered better as a sealer on surfaces receiving impact such as floors. Shellac Varnish may be specified by manufacturer's brand name and mentioning that it is to be 4-lb. cut or by reference to ASTM Spec. D360, *Grade A Orange* (or Refined Bleached) and light bodied or by reference to Fed. Spec. TT-V-91b, *Type I* (Bleached) or *Type II* (Orange), *Grade B* and Body No. 1. (For other grades and types of bodies, see the ASTM and the Fed. Spec. mentioned.)
- f. *Floor Varnish* is a varnish used for transparent coats over properly filled, stained and sealed interior wood flooring. It may be specified by manufacturer's trade name or by reference to Fed. Spec. TT-V-71d.
- g. *Wax for Wood Floors* may be specified by manufacturer's brand name or by reference to Fed. Spec. P-W-158, *Type II* paste form (*Type I* is liquid form). This wax requires buffing and polishing.  
Alternate specification is to call for Liquid Wax with resins by manufacturer's trade name or by reference to Fed. Spec. P-W-155. This wax does not require buffing and polishing.

### 23-9 FINISHING WOOD FLOORS

- a. *Sanding*: It should be specified that all wood floors shall be cleaned and then sanded by traversing the surfaces several times using machine sanders. The final buffing should be with fine sandpaper or No. 0 steel wool. Floors near walls and corners should be sanded with a small hand-operated sander (or scraped with a hand scraper tool for especially fine work).
- b. *Penetrating Sealer Finish* in 2 coats is recommended by flooring manufacturers in lieu of the old type shellac and varnish finish, because of the economy of application and its patchable quality. Penetrating sealer should be oil type requiring wiping after penetration and applied in full accordance with manufacturer's specifications. Finish should be buffed between coats with No. 2 steel wool on electric polishing machine. For oak floors, paste wood filler should be applied after buffing between coats.
- c. *Stain Finish* (alternate for b above) is also recommended by flooring manufacturers. It is specified by requiring an oil stain to be first applied and wiped off with a soft cloth, and then a dark filler applied, if the flooring is open grain, by brushing across the grain.
- d. *Shellac and Varnish Finish* (alternate for b above) is not recommended by flooring manufacturers but has been used extensively in the past. This type of finish is generally specified as follows:

- 1 coat of oil stain (if desired)
- 1 coat of paste wood filler (if flooring is open grain wood)
- 1 coat of shellac
- 2 coats of floor varnish

- e. *Waxing and Buffing:* Regardless of the finish called for, it should be protected and prepared for use by specifying the surfaces to be given a coat of paste wax and thoroughly buffed and polished.

### 23-10 READY-FINISHED HARDWOOD FLOORING

There are several manufacturers furnishing ready-finished hardwood flooring of many designs and requiring no sanding and finishing after installation. Some are  $1\frac{3}{16}$ " thick, tongue and grooved and end matched and are applied in the same manner as regular wood flooring. Some of the flooring is of wide planks requiring screws in addition to nails. Some of the ready-finished hardwood flooring is made up of thin pieces cut 9" x 9", 9" x 18" and 9" x 27" and laid in mastic. Ready-finished hardwood flooring should be specified by manufacturer's trade name and by reference to or repetition of the manufacturer's specifications for installation.

### 23-11 RESILIENT FLOORING

*Resilient Flooring* is the general term used to designate interior types of flooring produced in thin sheets or tile composed principally of asphalt, oxidized linseed oil, rubber, cork or vinyl resins. The types of resilient flooring often used are known as Asphalt Tile, Linoleum, Rubber Tile, Cork Tile and Vinyl Asbestos Tile.

### 23-12 ASPHALT TILE FLOORING

- a. *Use:* Asphalt tile is the least expensive resilient flooring and is probably the best to specify for use over concrete in contact with the earth. Asphalt tile is often used as flooring in Play Rooms, Kitchens, Dining Areas and Bath Rooms. When asphalt tile is specified for kitchens of rental property or for other locations where grease, oil or foodstuffs will come in contact with the floor and will probably not be removed immediately, greaseproof asphalt tile should be specified.
- b. *Type:* Asphalt tile may be specified by brand name or by requiring it to meet the requirements of Fed. Spec. SS-T-306b. Since the manufacturers have established Color Groups *A*, *B*, *C* and *D*, the specification writer should designate the group or the percentage of each if more than one group is to be used. *Group A* includes the dark plain colors and is the least expensive, and *Group D* includes the lightest colors and is the most expensive; *Groups B* and *C* are graded between these two extremes.

- c. *Size:* Asphalt tile is made in  $\frac{1}{8}$ " and  $\frac{3}{16}$ " thicknesses. Thickness of  $\frac{1}{8}$ " is recommended for light duty and  $\frac{3}{16}$ " for heavy duty surfaces. Standard sizes include 9" x 9", 12" x 12" and 18" x 24". The 9" x 9" is most often specified for residences. Special sizes include 3" x 3", 3" x 6", 6" x 6" and 12" x 24".
- d. *Pattern:* There are a great variety of patterns that could be specified. A typical paragraph covering the description of one pattern might read as follows:

"Field shall be of 9" x 9" tile 50% selected from Group B colors and 50% selected from Group C colors laid checkerboard with a 6" to 9" border selected from Group A colors." (For other group colors see Subparagraph *b* above.)

- e. *Installation:* It is usually sufficient to write that asphalt tile shall be installed in full accordance with the manufacturer's specifications (or in full accordance with specifications published by the Asphalt Tile Institute) using adhesives recommended by the manufacturer and laying 15-lb. asphalt-saturated felt over wood floors to be covered by asphalt tile.
- f. *Asphalt Base:* A paragraph covering asphalt base is usually written as follows:

"Asphalt base shall be installed where called for in Finish Schedule. Asphalt base shall be of the set-on, cove type, 4" (or 6") high and in standard color to be selected. Inside and outside corners of asphalt base shall be formed on the job and installation shall be in full accordance with the manufacturer's printed instructions."

### 23-13 LINOLEUM FLOORING

- a. *Use:* In cost linoleum usually falls between asphalt tile and rubber tile and is often used in Play Rooms, Kitchens, Dining Areas and Bath Rooms but should not be used over concrete in contact with the earth. Areas where linoleum should be installed on floors need not be mentioned if called for in Finish Schedule.
- b. *Linoleum* may be specified by brand name or by requiring it to meet the requirements of Fed. Spec. LLL-L-359 for inlaid and moulded types or LLL-L-367 for plain, jaspé and marbleized types.
- c. *Size:* Linoleum is made in two thicknesses; Standard ( $\frac{3}{32}$ ") on felt backing and Heavy ( $\frac{1}{8}$ ") on burlap backing. Standard gauge is usually specified for residential work, and Heavy gauge is generally specified for commercial work. Linoleum is made in rolls 6' wide.
- d. *Pattern:* A typical paragraph covering the description of pattern could read as follows:

"Field shall be marbled (jaspe, plain or inlaid and moulded) linoleum and border shall be 6" to 9" wide of plain linoleum with feature strip 1" wide of plain linoleum. Colors to be selected by the Architect."

- e. *Installation:* The specification covering linoleum should require the linoleum to be laid in full accordance with the manufacturer's specifications using adhesives recommended by the manufacturer and laying 15-lb. asphalt-saturated felt over wood floors to be covered with linoleum.
- f. *Linoleum Base:* A paragraph covering linoleum base might be written as follows:

"Linoleum base shall be installed where called for in Finish Schedule. Linoleum base shall be flash type with cove base of  $\frac{1}{8}$ " plain linoleum (for other types see Subparagraph b above)  $4\frac{1}{2}$ " (or 6") high, color to be selected. Install  $\frac{3}{8}$ " wax filler strip, and metal binding strips, end stops and corner pieces and fit linoleum in full accordance with manufacturer's specifications."

## 23-14 RUBBER TILE FLOORING

- a. *Use:* Rubber tile costs more than asphalt tile or linoleum but wears much longer and is used extensively in public places. For residences it is sometimes used in entrance halls and in the same areas where asphalt tile or linoleum might be used. Rubber tile should not be laid over concrete in contact with earth.
- b. *Rubber Tile* may be specified by brand name or by requiring it to meet the requirements of Fed. Spec. ZZ-T-301a. Some of the manufacturers divide their colors into groups: *Standard Colors* which are the darker and less expensive and *Premium Colors* which are lighter and more expensive.
- c. *Size:* Rubber tile is generally made in  $\frac{1}{8}$ " thickness used for light duty and in  $\frac{3}{16}$ " thickness used for heavy duty. The standard sizes are 6" x 6", 9" x 9" and 12" x 12". Border tile is usually furnished in 36" lengths. Rubber flooring is sometimes installed in sheet form the same as linoleum.
- d. *Pattern:* A typical paragraph covering the description of pattern could read as follows:

"Field shall be of 9" x 9" Premium Color tile laid checkerboard with a 6" to 9" border of Standard Color tile."

- e. *Installation:* The specification covering rubber tile should require the tile to be laid in full accordance with the manufacturer's specifications using adhesives recommended by the manufacturer and laying 15-lb.

asphalt-saturated felt over wood floors to be covered with rubber tile.

- f. *Rubber Base:* A paragraph covering rubber base could be written as follows:

"Rubber base shall be installed where called for in Finish Schedule. Rubber base shall be of the set-on, cove type, 4" (or 6") high. Install pre-moulded end pieces and external and internal corners. Installation shall be in full accordance with manufacturer's specifications."

### 23-15 CORK TILE FLOORING

- a. *Use:* Cork tile falls in about the same price range as rubber tile. It is highly resilient but probably does not wear as well as rubber tile, although the development of synthetic resins employed in its manufacture has increased its strength. Cork tile is used in the same areas where one would use Oak flooring in residences or apartments.
- b. *Cork Tile* may be specified by brand name or by requiring it to meet the requirements of Fed. Spec. LLL-T-431. Some of the manufacturers make the cork tile in all light colors or all dark colors; other manufacturers make the cork in random color ranges from light to dark.
- c. *Size:* Cork tile is generally made in two gauges— $\frac{5}{16}$ " and  $\frac{3}{16}$ ". The  $\frac{3}{16}$ " gauge is usually specified for residential work and the  $\frac{5}{16}$ " gauge for commercial work. The standard sizes are usually 6" x 6", 9" x 9" and 12" x 12". Special sizes can be cut from sheets up to 24" x 48".
- d. *Pattern:* A typical paragraph covering the description of pattern could read as follows:

"Field shall be of 9" x 9" of random colored cork laid checker-board with 6" to 9" border of dark colored cork tile."

- e. *Installation:* The specification covering cork tile should require the tile to be laid in full accordance with manufacturer's specifications using adhesives recommended by the manufacturer and laying 15-lb. asphalt-saturated felt over wood floors to be covered with cork tile.

### 23-16 VINYL ASBESTOS TILE FLOORING

- a. *Composition:* Vinyl-asbestos tile are made from vinyl resin combined with asbestos fiber and special inert fillers and coloring. It is semiflexible in nature.
- b. *Use:* Vinyl-asbestos tile is probably the best buy in resilient flooring. It requires less maintenance than the other resilient flooring materials due to its finely textured surface. It is greaseproof and has good resistance to acids and alkalies. It has excellent resistance to indentation and can be used over wood or over concrete on or below grade.



- c. *Vinyl-Asbestos Tile* may be specified by brand name or by requiring it to meet the requirements of Fed. Spec. L-T-751 (GSA-FSS) Type I semiflexible.
- d. *Size:* Vinyl-asbestos tile is made in  $\frac{1}{16}$ ",  $\frac{3}{32}$ " and  $\frac{1}{8}$ " thicknesses. Thickness of  $\frac{3}{32}$ " is recommended for residential work, and  $\frac{1}{8}$ " thickness for commercial work. Standard sizes include 9" x 9" and 12" x 12". The 9" x 9" is most often specified.
- e. *Pattern:* The two major patterns are marbelized type and terrazzo type. There is no difference in cost provided it is required that there be a uniform dispersement of color and texture throughout the tile.
- f. *Base:* Some Architects specify rubber base to be used with the vinyl-asbestos tile flooring, whereas others specify a vinyl base. A paragraph covering vinyl base could be written as follows:

"Vinyl base shall be installed where called for in Finish Schedule. It shall be black (red, gray, beige, green, Brittany red) and 4" ( $2\frac{1}{2}$ ", 6") high."

- g. *Note:* Another more expensive vinyl tile known as Homogeneous Vinyl Tile in thicknesses of  $\frac{3}{32}$ " and  $\frac{1}{8}$ " is also manufactured. Vinyl is also furnished in sheet form 0.045" thick for covering counter tops and the like.

### 23-17 EDGING STRIPS

It should be specified that edging strips shall be installed at all edges where resilient flooring ends and wood or concrete floors begin. These edging strips may be specified to be of extruded aluminum or brass applied with oval head screws or of asphaltic or plastic material applied with mastic.

### 23-18 WAXING RESILIENT FLOORING

All types of resilient flooring should be protected and prepared for use by specifying that the surfaces be cleaned and then given two coats of water-emulsion wax, referring to the manufacturer's brand name or to Fed. Spec. P-W-155. This liquid type wax does not require buffing and polishing unless a high glossy finish is desired.

### 23-19 MODULAR TILE

This chapter has pointed out that 9" x 9" resilient tile is usually specified, and this size is in keeping with tradition; however, to encourage the recommendations of the Modular Standards Association, specification writers should start calling for 12" x 12" tile. This size fits into the 4" grid system, and for commercial work it matches the 12" x 12" traditional size of acoustical tile.

## CHAPTER 24

# Painting

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### 24-1 GENERAL

- a. *Workmanship:* It should be specified in the *Painting* section that all work shall be done by skilled mechanics and no coat shall be applied until the preceding coat is thoroughly dry. All finish paint surfaces shall be smooth and even.
- b. *Sanding:* Enamel and varnish finishes should be rubbed with steel wool or sandpaper between coats to produce an even surface. Other finishes are to be rubbed with steel wool or sandpaper only when it is necessary to eliminate defects.
- c. *Delivery of Materials:* Painting specifications often require that all materials shall be delivered to the job in unbroken containers bearing the manufacturer's brand and name. Painting specifications sometimes mention that the paint shall be stored in one place in the building.
- d. *Protection:* It should be specified that all surfaces shall be protected by drop cloths where possible and that paint spots shall be removed immediately from finish surfaces.
- e. *Tinting:* In recent years paint manufacturers have offered a wide variety of colors for use in decorating. Architects and decorators, therefore, now have available to them a wide range of colors in mixed form. Also, some paint manufacturers furnish decorator services for architects in which color schemes are developed for specific jobs. The specification should state that the contractor will be required to match colors selected by the architect and to prepare samples for approval. It is often added that all undercoats of paint and enamel shall be tinted to the approximate shade of the final coat.
- f. *Application:* It is usually specified that paint shall be applied by brush, roller or spray, and that complete coverage and a reasonable smoothness and uniformity of finish coats will be required.

## 24-2 MATERIALS

- a. If the specification writer selects manufacturer's brand names to specify, he should remember that many of the manufacturers have a "competitive" line in addition to a "quality" line of paint. It would not allow proper competition to call for the "competitive" line of one manufacturer and the "quality" line of another.
- b. The paints and painters' materials identified and discussed in this chapter are those most often used in small frame type buildings. However, they are also suitable for large buildings of many types. There are many other paint products that are not included. Lacquers have been excluded because they should not be applied over oil base paint. They are highly flammable and are more suitable for spray than for brush application. The paints and painters' materials included have been separated into the following groups:
  1. Oil and varnish base paints
  2. Alkyd base paints and enamels
  3. Latex paint
  4. Water paints
  5. Varnish and stains
  6. Mixing Liquids
  7. Miscellaneous materials
- c. In general, proprietary items made by reliable paint manufacturers should be specified for all jobs. Whereas formerly federal specifications were often referred to in project, it is evident that the paint manufacturers have in most cases made advances over the specification items available. Therefore, more up-to-date formulations for a specific job are available by specifying manufacturers' items. Many manufacturers supply excellent descriptive brochures and literature for the use of the architect.

## 24-3 OIL AND VARNISH BASE PAINTS

- a. Paint is a liquid composed of pigment and vehicle, which forms an opaque, solid film after application as a thin layer. The word "pigment" means the fine solid particles and the word "vehicle" means the liquid portion of a paint. The binder is that portion of the vehicle which remains as a permanent portion of the film. The binder may be drying oils which are products of nature or varnish solids that are made by processing drying oils and hard resins together.
- b. *Exterior Primer* is a ready mixed oil paint used primarily as the first coat on woodwork outside the buildings. This primer should be specified as especially designed for a first coat on wood and made by a reliable paint

manufacturer. The companion finish coat product for the primer should be stated also.

- c. *Sheet Metal Primer* is a ready mixed oil paint made with zinc dust and zinc oxide and is used principally for priming exterior galvanized metal and zinc surfaces. A suitable product made by a reliable manufacturer having the general composition indicated should be specified.
- d. *Red Lead Base Paint* is a ready mixed oil paint used as a primer on steel and iron surfaces.
- e. *Outside Paint* is a ready mixed oil paint used principally for additional coats over suitably primed exterior wood and metal surfaces. The best quality finish coat offered by reliable manufacturers for the job at hand should be specified.
- f. *Concrete and Masonry Paint* is a ready mixed oil paint with a flat or eggshell (matt finish) used principally for coats over suitably primed exterior concrete, brick and stucco surfaces. Only products made by companies having a reputation for furnishing adequate products for painting such surfaces should be specified.
- g. *Rubber Base Paint* (solvent type) is a ready mixed paint used primarily on interior concrete floors subject to dampness. Manufacturers products known to be made specifically for this difficult type surface should be specified.
- h. *Aluminum Paints* are mixtures of aluminum powder or paste with varnish binder. Aluminum paints are available in ready mixed form or may be furnished in double compartment containers. In the latter case, the powder or paste is mixed with the vehicle immediately prior to use. In specifying aluminum proprietary items may be designated. However, a distinction should be made between interior and exterior demands for usage.
- i. *Shake Paint* is a flat sheen exterior oil paint usually having a high pigment content, intended for specific use on wood shakes and shingles. Proprietary products of reliable manufacturers should be specified.

#### 24-4 ALKYD PAINT AND ENAMEL

- a. Alkyd paints and enamels contain alkyd resin as the binder. Alkyd resin is a form of synthetic resin binder. A typical alkyd resin can be made by the interaction of glycerin, phthalic anhydride and drying oils. Many types of alkyd resins are made, and outstanding paint products can be manufactured from them.
- b. *Exterior Alkyd Paints* and trim enamels are products which use alkyd resin as binder. These products are finish coats for suitably primed wood, metal and masonry surfaces. Alkyd paints for exterior are usually the dark colored products,

- c. *Floor and Deck Enamel* is a ready mixed enamel used especially on exterior and interior wood and concrete floors not subject to dampness. This product should be specified as a proprietary product made by a reliable manufacturer.
- d. *Pigmented Primer* sealer is a ready mixed alkyd product used as a priming or sealing coat on interior plaster, masonry and wallboard surfaces.
- e. *Enamel Undercoat* is a ready mixed paint used either as a first coat on interior wood trim surfaces or as an intermediate coat in general interior trim and wall painting. It dries to a sufficiently hard surface to be sanded.
- f. *Flat Finish* is a ready mixed alkyd paint without gloss used for coats over properly primed interior wood, enamel, plaster, masonry or sheetrock surfaces.
- g. *Eggshell Finish* is a ready mixed alkyd paint with a matt or semigloss finish used over properly primed interior wood, metal, plaster, masonry or sheetrock surfaces. Proprietary products of reliable manufacturers should be specified. It should be noted that eggshell, semigloss and gloss enamels made with alkyd can have a high degree of nonyellowing features. In that sense, they are definitely preferable to previously used varnish type products.
- h. *Semigloss Enamel* is a ready mixed oil paint with a matt or semigloss finish used principally for coats over properly primed interior wood, metal, plaster, masonry or sheetrock surfaces. Semigloss enamel would have superior washing properties over flat or eggshell products.
- i. *Gloss Enamel* is a ready mixed alkyd paint with a high gloss finish used principally for coats over properly primed interior wood, metal, plaster and masonry surfaces.

#### 24-5 LATEX PAINT

- a. The term "latex" means milky liquid. A latex is a vehicle in which synthetic resin particles are emulsified in water. Paints using such a binder are called latex paints. They are water thinned. The various latexes differ from each other in chemical composition. Important kinds are vinyl latex, acrylic latex and butadiene styrene latex. There are other types of commercial significance in development stage.
- b. *Flat Latex* finish is a ready mixed latex paint without gloss used on interior plaster, wood, metal, masonry and sheetrock surfaces. In many instances the latex flat finish may also serve as a primer. However, when used over wood, an alkyd enamel undercoat is the preferred primer, and, when applied over metal, a suitable metal primer must be used.
- c. *Latex Primer Sealer* is a ready mixed latex paint used as a priming or sealing coat on interior plaster, gypsum wallboard, or masonry surfaces.

This primer is preferred on gypsum wallboard surfaces because of the ability to lay nap.

- d. *Exterior Concrete and Masonry Latex Paint* is a ready mixed latex paint with a flat or matt finish. Properly used it is an excellent finish for stucco, concrete, concrete block, and other forms of masonry. Only products made by reliable manufacturers having a background of experience in masonry painting should be used. Specific recommendations for the individual type of masonry surfaces shall be followed.
- e. *Filler Coat* is a heavy bodied mixture of pigment and latex binder. Its chief use is to fill the pores of exterior open-textured concrete blocks so as to develop a waterproof surface when additional protective coatings are applied. It may be used on interior surfaces of the same kind to modify the texture and appearance of such wall surfaces. Proprietary filler coats are available.

#### 24-6 WATER PAINTS

- a. Water paints are paints containing pigment dispersed in water or water soluble binder. These paints are often furnished in powder or paste form and water is added at the job. They are to be distinguished from latex paints. Water paints are usually less expensive than oil paints, and they do not form a hard firm surface nor are they washable.
- b. *Portland Cement Water Paint* is a water paint furnished in powder form made of Portland Cement and hydrated lime with pigments added. It is used on masonry, concrete and stucco surfaces. Proprietary items are obtainable from various manufacturers.
- c. *Resin Emulsion Paint* is a water thinned paste paint used principally for painting interior plaster and wallboard surfaces. It may be specified by manufacturer's brand name. Products of this type are not used to the extent that they were formerly used.

#### 24-7 STAINS AND VARNISHES

- a. *Oil Stains* covered under this heading are the preferred type stains for general use. Stains made with creosote are not recommended because of their tendency to bleed through future coats of paint.
- b. *Varnishes* are liquids which are converted to a thin transparent film after application in a thin layer. Not included in subparagraph below is varnish for mixing aluminum paint. Floor varnish and varnish type floor sealers are discussed in Chapter 23.
- c. *Exterior Oil Stain* is a thin liquid made of oils and pigments and is used for tinting and helping to preserve exterior wood surfaces. Care should be used in selection to make sure that permanent pigments are used.
- d. *Interior Oil Stain* is a thin liquid used to modify the color of interior

wood surfaces without obscuring the natural grain. Suitable proprietary products from reliable manufacturers should be specified and their instructions for application followed.

- e. *Sanding Sealer* is a quick drying varnish product used as a first coat on unfilled or filled bare wood. When subjected to light sanding it presents a smooth sealed surface particularly fine for receiving further coats. Proprietary products of high quality are available.
- f. *Shellac Varnish* is made from shellac, a material produced from the secretion of an insect and an alcohol solvent. It is used principally as a transparent sealer on properly filled and stained wood surfaces. It may be specified by manufacturer's brand name and by stating that it is to be 4-lb. cut, or by reference to ASTM Spec. D360, Grade A, Orange (or Refined Bleached) and light bodied, or by reference to Fed. Spec. TT-V-91b, Type I, bleached (or Type II Orange), Grade B and Body No. 1. (For other grades and types of bodies, see the ASTM and Fed. Spec. mentioned.)
- g. *Rubbing Varnish* is a varnish used principally for transparent coats over properly filled, stained, and sealed interior wood surfaces where an expensive smooth rubbed finish is desired. Choose a suitable product furnished by a reliable manufacturer with the understanding that the product can be successfully rubbed to desired sheen and smoothness.
- h. *Satin or Rubbed Effect Varnish* is a varnish which, when dry, has the appearance of a rubbed effect surface. Proprietary products of known good performance features and water resistance may be specified for this finish.
- i. *Spar Varnish* is a varnish used mainly for transparent coats over properly filled, stained and sealed exterior (or interior work surfaces). This product should have a proven record of exterior durability. Only products specified for exterior usage by reliable manufacturers should be used.

#### 24-8 MIXING LIQUIDS

- a. The liquids included under this heading are liquids not generally used alone but are often mixed in paints to get varying effects. They are primarily drying oils, driers and thinners. Liquids having suitable purity and of standard composition are generally available and can be obtained by proper descriptive designation.
- b. *Linseed Oil* is one of the main drying oils. Raw linseed oil will not dry as rapidly as boiled linseed oil unless a drier is added. Linseed oil of both types may be obtained commercially.
- c. *Paint Drier* is a liquid that accelerates the drying of oil paint or varnish.

Suitable commercial driers should be specified when needed. These are usually the resinate or linoleate types.

- d. *Turpentine* is a thinner used for oil paints, alkyd paints and oleoresinous varnishes. It is obtainable commercially. It may be of the gum spirits type, steam-distilled wood turpentine or sulfate wood turpentine.
- e. *Mineral Spirits* is the thinner commonly used in oil paints, alkyd paints or varnish products. It is a petroleum type product and is readily obtainable commercially.

#### 24-9 MISCELLANEOUS MATERIALS

- a. Various materials required for an adequate job are not classifiable under the preceding categories. Listed below will be a series of materials generally used.
- b. *Paste Wood Filler*, a mixture of silex and quartz and quick drying varnish, is used principally to fill the pores of open-grained wood such as Oak. It may be mixed on the job or obtained as a proprietary item from a reliable manufacturer. Listed below are the woods possibly used in architectural jobs and a statement as to filling requirements.

##### *Open-Grain Woods* (*Filler Necessary*)

Ash  
Butternut  
Chestnut  
Elm  
Hackberry  
Hickory  
Mahogany  
Oak  
Rosewood  
Walnut

##### *Close-Grain Woods* (*Filler Unnecessary*)

Alder, Red	Gum
Aspen	Hemlock
Basswood	Magnolia
Beech	Maple
*Birch	Pine
Cedar	Poplar
*Cherry	Redwood
Cypress	Spruce
Cottonwood	Sycamore
Fir	Whitewood

\* Will take paste filler when desired to emphasize grain.

- c. *Linseed Oil Putty* should be specified for filling nail holes and cracks. It may be specified by manufacturer's brand name. On ordinary interior jobs regular putty may be used, but in some cases for special durability on exterior surfaces, a white lead putty should be specified.
- d. *Water Base Putty* is a putty made with water as a thinner. It will not bleed when latex paints are used over it. Cracks and holes on surfaces which are to be finished with latex paint should be filled with a water base putty.
- e. *Spackle* is a powder material which, when mixed with water, can be used



to fill cracks and other imperfections on plaster type surfaces and which will harden to a state acceptable for painting work. In doing repaint work involving repair, spackle should be used to overcome imperfections from cracks and plaster breaks.

- f. *Tinting Colors* were in former times designated as colors-in-oil. However, manufacturers have offered a variety of new tinting colors. In addition to the traditional colors in oil, colors in alkyd, latex tinting colors, and Universal Tinting Colors are now available. The latex tinting colors were designed specifically for use with latex paints. The so-called Universal Colorants were designed to tint both oil and alkyd type paints as well as latex paints. In using such colors, care should be exercised to have compatible systems.

#### 24-10 PREPARATION OF SURFACES TO RECEIVE PAINT

- a. It should be stated that all surfaces to be painted shall be free from dirt and dust before painting is started. The following paragraphs should be used for further requirements:
- b. "*Plaster Surfaces* shall be thoroughly dry before priming coat is applied. Tint the priming coat the approximate shade of final coat. All suction spots, commonly called 'hot spots,' occurring after the application of priming coat shall be touched up before the application of second coat."
- c. "*Wood Surfaces*: Cover all knots and sappy spots with coat of shellac (or aluminum paint) before priming. Putty all countersunk holes, cracks and open joints in woodwork and space between plaster and trim. Putty shall be tinted to match finish color and shall be applied after priming. Wood surfaces to receive enamel or varnish finishes shall be sanded smooth before first coat is applied."
- d. "*Galvanized Metal Surfaces*: Clean surfaces with turpentine or mineral spirits to remove all oil or other foreign matter, then apply one coat of Sheet Metal Primer." (Alternate: "Treat surfaces with a good phosphate chromate, then apply one coat of Red Lead Base Paint.")
- e. "*Iron and Steel Surfaces*: Iron and steel surfaces shall be wire brushed and sanded to brightness before applying metal primer.

#### 24-11 PAPERING OR VINYL WALL COVERING

In decorating a home, some of the walls are often papered or covered with vinyl wall covering. Since it is not necessary for these walls to be painted, they should be identified and excluded in a paragraph of this title. The specification may require the papering or vinyl wall covering to be done; then it should require the paper or vinyl wall covering to be applied carefully with butt joints and aligned patterns and the work to be done by experienced paper hangers. It should be noted whether the paper or vinyl wall

covering will be purchased by the Owner or purchased by the Contractor under an allowance of a stipulated amount per roll for wall paper or per sq. ft. for vinyl wall covering.

#### 24-12 SURFACES TO BE PAINTED

It is difficult to include in the drawings a painting schedule. Therefore, the specifications have to describe all surfaces to be painted. These surfaces are divided into Exterior Surfaces and Interior Surfaces, Paragraphs 24-13 and 24-14 below.

Specification paragraphs are given for selection. The first list of coats mentioned under each of the headings is considered to be the best and is usually the most expensive. The alternate list may not be as good and may be less expensive.

#### 24-13 EXTERIOR SURFACES

*a. Masonry (stucco, concrete block, and concrete):*

- 1 coat of Latex Paint (Modified or used as specified by Manufacturer) (Exterior Latex Masonry Paint)
- 1 coat of Latex Paint Finish

*b. Masonry (open-textured block—Celocrete, etc., Cinder):*

- 1 coat of Filler Coat
- 1 coat of Latex Finish (Exterior Latex Masonry Paint)
- 1 coat of Latex Finish  
(Last coat may be omitted)

*c. Masonry (Brick):*

- 1 coat of Exterior Oil Primer
- 1 coat of Concrete & Masonry Paint or Exterior Latex Masonry Paint

Alternate for *a, b, c* above:

- 2 coats of Portland Cement Water Paint

*d. Wood Surfaces* not otherwise specified should be given:

- 1 coat of Exterior Primer
- 2 coats of Outside Paint

Alternate:

- 1 coat of Exterior Primer
- 1 coat of Outside Paint

*e. Back Priming:* All exterior wood trim should be back-primed before installation (as an alternate, this may be omitted entirely).

- f. *Pulley Stiles* of Double Hung Wood Windows should be oiled with Boiled Linseed Oil and are not to be painted.
- g. *Exterior Doors* (Clear Finish) should be given:

- 1 coat of Exterior Oil Stain
- 1 coat of Paste Wood Filler
- 3 coats of Spar Varnish

*Note:* If close-grain wood, omit the Paste Wood Filler. If natural color of wood is satisfactory, omit the Exterior Oil Stain.

- h. *Wood Siding* should be given a natural wood finish as follows:

- 3 coats of Spar Varnish.

- i. *Wood Shingles* or Shakes:

- 1 coat of Exterior Oil Primer
- 1 coat of Exterior Latex or Shake Paint

Alternate:

- 1 coat of Exterior Oil Stain by dipping  $\frac{2}{3}$  its length before installation
- 1 coat of Exterior Oil Stain applied with brush after installation

- j. *Metal Surfaces:* All galvanized and ferrous metal surfaces should be given the following in addition to prime or shop coat:

- 2 coats of Outside Paint

Alternate:

Omit the second coat mentioned above.

- k. *Concrete and Wood Floors* should be given:

- 2 coats Floor & Deck Paint

#### 24-14 INTERIOR SURFACES

- a. *Plaster Surfaces* except as otherwise specified should be given:

- 1 coat of Pigmented Primer tinted
- 2 coats of Alkyd Flat Finish or Latex Flat Finish

Alternate:

Omit third coat mentioned above.

- b. *Plaster Surfaces of Kitchen and Bathrooms* should be given:

- 1 coat of Pigmented Primer and Sealer tinted
- 1 coat of Enamel Undercoater
- 1 coat of Alkyd Semi-Gloss Enamel

## Alternate 1:

- 1 coat of Pigmented Primer and Sealer tinted
- 2 coats of Alkyd Eggshell Finish

## Alternate 2:

Omit intermediate coat in both cases above.

- c. *Gypsum Wallboard Surfaces* except as otherwise specified should be given:

- 1 coat Latex Primer Sealer
- 2 coats of Latex Flat or Alkyd Flat Paint

## Alternate:

Omit third coat mentioned above.

- d. *Gypsum Wallboard Surfaces of Kitchen and Bathrooms* should be given:

- 1 coat of Latex Primer Sealer
- 2 coats of Alkyd Semi-Gloss Enamel  
(Eggshell or Gloss Enamel may be used also)

## Alternate:

Omit third coat above.

- e. *Interior Masonry Surfaces* should be given:

- 2 coats of Latex Flat Paint

- f. *Wood Paneling* to receive a clear finish should be given:

- 1 coat of Paste Wood Filler
- 1 coat of Sanding Sealer
- 2 coats of Clear Varnish

## Alternate 1:

The last coat may be Satin or Rubbed Effect Varnish.

## Alternate 2:

One of the varnish finish coats may be omitted in filled open-texture wood situations.

Note: If close-grain wood, omit the Paste Wood Filler.

- g. *Wood Paneling (Stain Finish)* should be given:

- 1 coat of Wood Filler, cut 50/50 with oil stain
- 1 coat of Sanding Sealer
- 2 coats of Clear Varnish

Alternate: Same as for clear wood finish above (Subparagraph f).

- h. *Back Priming*: All interior wood trim should be back-primed before installation. (As an alternate this may be omitted entirely.)
- i. *Concrete Floors* in Basement should be roughened by etching with a solution of 1 pint of muriatic acid to 1 gallon of water, then given:

2 coats of Rubber Base Paint

- j. *Metal Surfaces*: All ferrous metal surfaces shall be painted same as specified for woodwork in addition to shop or prime coat.
- k. *Wood Surfaces*, except as otherwise specified, should be given:
  - 1 coat of Enamel Undercoater
  - 2 coats of Alkyd Semi-Gloss Enamel

Alternate 1:

- 1 coat of Enamel Undercoater
- 2 coats of Alkyd Eggshell Finish

Alternate 2:

Omit intermediate coat in both cases above

## 24-15 WOOD FLOORS

It should be called to the Painting Contractor's attention that the sanding and finishing of wood floors are specified in the *Flooring* section of the specifications.

## CHAPTER 25

# Asphalt Paving

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### 25-1 GENERAL

In the preparation of a specification section covering Asphalt Paving, the best method to use is to base the work as much as possible on the Standard Specifications of the local State Highway Department. Since the soil conditions vary and the customs and requirements of highway departments vary in each state, the recommendations in this chapter may not apply; but they are typical of the manner in which asphalt paving is specified in Georgia around the Atlanta area.

### GENERAL CONDITIONS COVERING ASPHALT PAVING

#### 25-2 SUBGRADE

- a. *Rough Grading* should be specified in the Earth Work section to within 0.2 ft., plus or minus, of finished subgrade elevations.
- b. *Grades* should be so established that surface water will be properly drained away. Slope should be not less than 1% minimum.
- c. *Drainage* from adjacent areas should be properly carried away, so that washouts will not occur around paving edges and surface water will not get under pavement.
- d. *Paving* should be done whenever possible in dry weather when subgrade is sufficiently stable to be properly compacted. Ground moisture should not be sealed under the pavement because spongy areas will result and cracks will occur in surface course. This condition allows more water to enter and eventually the pavement in these areas will break out. When poor moisture conditions occur, consideration should be given to the types of bases which are more adaptable. (See Types of Bases.)

#### 25-3 DESIGN FOR TRAFFIC

In the design of asphalt pavement, careful attention should be given to the traffic conditions to which the pavement will be subjected. It is poor econ-

omy to attempt to "get by" with a design that is less than the present and future needs may indicate.

## GENERAL TYPES OF ASPHALT PAVING

### 25-4 BASE COURSES

- a. *Soil Bound Macadam*: A mixture of course aggregate (crushed stone or slag) and soil mortar (sand clay, topsoil, chert or screenings). Mixing is done on site. (See the proper section of local State Highway Department Specifications.)

*Remarks*: This is a serviceable base if proper soil mortar is economically available locally. It is difficult to apply and mix properly in bad weather and in areas where space to operate mixing equipment is limited.

- b. *Crusher Run Base*: A premixed graded stone containing coarse aggregate, smaller binder stone and screenings. (See the proper section of local State Highway Department Specifications.)

*Remarks*: This is a good base for general use. It can be applied to subgrades that may not be dry enough for other types. Traffic may move over this application before topping is applied, and subgrade moisture will dissipate through the porous material. Top may then be applied under better weather conditions.

- c. *Bituminous Bound Base*: Coarse aggregate is applied to approximate thickness of finished course and treated with hot asphalt cement. Surface voids are then filled by rolling in fine aggregate. (See the proper section of local State Highway Department Specifications.)

*Remarks*: High stability base. Subgrade must be reasonably dry as moisture will not "breathe through" after asphaltic cement is applied. Not recommended during winter months.

- d. *Plant Mixed Base (Black Base)*: A balanced mix of coarse and fine aggregate and bituminous material prepared in a plant designed, coordinated and operated to produce a mixture within the tolerances set for the job. (See the proper section of local State Highway Specifications.)

*Remarks*: Used on all new work for City of Atlanta.

### 25-5 BITUMINOUS PRIME AND TACK COATS

- a. *Bituminous Prime Coat*: Bituminous seal to prevent subsurface moisture from penetrating surface course and to prevent precipitation from en-

tering base course. Can be omitted where such moisture is not anticipated. (See the proper section of local State Highway Specifications.)

- b. *Bituminous Tack Coat*: Used on existing pavement or previously prepared base where traffic has coated surface with dirt. Designed to assure bonding of surface course. (See the proper section of local State Highway Specifications.)

#### 25-6 PLANT MIX ASPHALTIC CONCRETE BINDER COURSE

A balanced mix of aggregate and bituminous material used as an intermediate course between a base course and an asphalt surface course. Binder course is usually a coarse-graded aggregate asphalt concrete.

*Remarks*: Serves to increase bond between base and surface course and tends to result in a smoother pavement. (See the proper section of local State Highway Department Specifications.)

#### 25-7 SURFACE COURSES

- a. *Bituminous Surface Treatment*: This is a wearing surface composed of single or multiple layers of aggregate bonded to the primed base or road surface by hot bituminous material. (See the proper sections of local State Highway Department Specifications.) May be Type 1 (Coarse Finish) or Type 2 (Fine Finish).

*Remarks*: Usually applied in areas where hot plant mixes are not economically available.

- b. *Plant Mix Surface Course*: This is a balanced mix of aggregate and bituminous material prepared in a plant that is designed, coordinated and operated to produce a mixture within the tolerances set for the job. (See the proper sections of local State Highway Department Specifications.)

*Remarks*: This is a durable, highly stable wearing surface that is notably nonskid and waterproof.

- c. *"Alabama Top"* is a plant mixed surface course of natural rock asphalt processed and treated with asphalt or flux as required by design mix.

*Remarks*: This surface course is principally used in Georgia by City of Atlanta for street work. Makes an extremely hard wearing surface, but is too brittle for use except over the more stable bases.

#### 25-8 SURFACE SEALERS

Coal tar pitch emulsion seal (Jennite J-16, Maintenance, Inc., Wooster, Ohio). This seals surface against action of water, gasoline and oil, oxidation, etc.



**25-9 PENETRATION MACADAM**

A complete pavement composed of crushed stone or slag placed in successive graduated spreads, and penetration applications of bituminous materials. (See the proper section of local State Highway Department Specifications.) This pavement should be applied only between April and November and in dry weather.

**25-10 CITY OF ATLANTA—CITY STREETS**

a. *Special Bituminous Paving* (in accordance with Specifications issued by Office of Chief of Construction, City of Atlanta, Ga., dated January 2, 1953):

1. Base Course: 200 lbs. of stone screenings (100% passing No. 8 sieve) scarified into the subgrade and shaped and compacted to true grade and cross section.
2. 4" Black Base (Hot Mix).
3. 1" Asphaltic Concrete "E" (Modified) Top.

*Remarks:* This paving is specified by City of Atlanta for cross streets and connectors not subjected to heavy through traffic.

b. *Regular Bituminous Paving* (in accordance with Specifications issued by Office of Chief of Construction, City of Atlanta, Ga., dated January 2, 1959):

1. 6" Black Base (Hot Mix).
2. 1" Asphaltic Concrete "E" (Modified) or Alabama Top.

*Remarks:* This paving is specified by City of Atlanta for main streets which are subjected to heavy through traffic.

**SUGGESTED PAVING APPLICATIONS****25-11 AVERAGE LIGHT TRAFFIC (Residential driveways, parking lots, etc.)**

- a. 4" Crusher Run Base  
1½" Plant Mix Surface Course
- b. 3" Bituminous Bound Base  
1" Plant Mix Surface Course
- c. 2½" Plant Mix Base (Black Base)  
1" Plant Mix Surface Course

*Note:* Areas having a fairly good existing base may be satisfactorily covered with 1" or 1½" Plant Mix Binder and 1" Plant Mix Surface Course.

**25-12 INTERMEDIATE TRAFFIC** (Schools, apartments, filling stations, commercial light traffic)

- a. 4" Crusher Run Base
  - 1" Plant Mix Binder
  - 1" Plant Mix Surface Course
- b. 4" Bituminous Bound Base
  - 1½" Plant Mix Surface Course
- c. 4" Plant Mix Base (Black Base)
  - 1" Plant Mix Surface Course

*Note:* Surfaces requiring protection from gasoline and oil should receive a surface sealer such as Jennite J-16.

**25-13 HEAVY TRAFFIC** (Truck freight terminals, manufacturing plants, commercial heavy traffic)

- a. 8" Crusher Run Base
  - Prime
  - 1½" Plant Mix Binder
  - 1" Plant Mix Surface Course
- b. 6" to 8" Bituminous Bound Base
  - 1½" Plant Mix Surface Course
- c. 6" Plant Mix Base (Black Base)
  - 1" Plant Mix Surface Course

*Note:* Surfaces requiring protection from gasoline and oil should receive a surface sealer such as Jennite J-16.

**SUGGESTED SPECIFICATIONS FOR ASPHALT PAVING****25-14 GRADING**

Rough grading is specified in Earth Work section to be done to within 0.2 ft., plus or minus, of finished subgrade elevations, and all drains and underground facilities installed. The subgrade shall then be thoroughly compacted with a power roller. All spongy spots developed during rolling shall be removed and replaced with good material that will compact satisfactorily upon rolling.

**25-15 BASE COURSE** (As Required by Pavement Design)

- a. \_\_\_\_\_ inches Soil Bound Macadam (meeting the requirements of the proper section of local State Highway Department Specifications.)
- b. \_\_\_\_\_ inches Crusher Run Base (meeting the requirements of the

proper section of local State Highway Department Specifications).

- c. \_\_\_\_\_ inches Bituminous Bound Base (meeting the requirements of the proper section of local State Highway Department Specifications).
- d. \_\_\_\_\_ inches Plant Mixed Base (Black Base) (meeting the requirements of the proper section of local State Highway Department Specifications).

*Note:* If the compacted thickness of the base course is in excess of four (4) inches, it should be constructed of two courses of equal thicknesses.

#### 25-16 BITUMINOUS PRIME COAT (If Required by Pavement Design)

Apply to the previously prepared base a bituminous prime coat (meeting the requirements of the proper section of local State Highway Department Specifications), at the rate of 0.10 to 0.30 gal. per sq. yd. Prime coat shall set for 24 hours before surface course is laid.

#### 25-17 BITUMINOUS TACK COAT (If Required by Pavement Design)

After the surface to be treated has been swept to remove all loose dirt, clay or other loose objectional material, apply a bituminous tack coat (meeting the requirements of the proper section of local State Highway Department Specifications) at the rate of from 0.05 to 0.20 gal. per sq. yd.

#### 25-18 ASPHALTIC CONCRETE BINDER (If Required by Pavement Design)

\_\_\_\_\_ inches Asphaltic Concrete Binder (meeting the requirements of the proper section of local State Highway Department Specifications).

#### 25-19 SURFACE COURSE (As Required by Pavement Design)

- a. \_\_\_\_\_ inches Plant Mix Surface Course (meeting the requirements of the proper section of local State Highway Department Specifications).
- b. Apply to the prepared base course a single (double) (triple) bituminous surface treatment Type I (Type 2). (It shall be constructed in accordance with proper section of local State Highway Department Specifications.)
- c. \_\_\_\_\_ inches Plant Mix 50-50 Rock Asphalt (Alabama Top) applied in accordance with specifications March 10, 1948, Office of Chief of Construction, City of Atlanta, Ga., approved March 15, 1948.

**25-20 SURFACE SEALER (If Required by Pavement Design)**

- a. Apply, as soon as practical after completion of the surface course, a coal tar pitch emulsion seal, similar or equal to Jennite J-16 (Maintenance, Inc., Wooster, Ohio), at the rate of 0.2 gal. per sq. yd. Application should be made in two uniform coatings in accordance with manufacturer's specifications.
- b. Over a surface course of rough texture where voids are too large to be filled to level with the emulsion, sand may be added to the first application in sufficient quantity to level all voids. The second application shall be without sand.

## CHAPTER 26

### Lawns and Planting

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#### 26-1 GENERAL

- a. In developing a specification section covering lawns and planting, it should be remembered that there are local problems due to the variance of soil conditions, weather, climate, temperature, and the practices of the local nurserymen.
- b. *Lawns and Planting* is a vast subject and this chapter can give only a few of the fundamentals. For a specification writer to develop a successful guide specification even for the landscape work of a simple residential site, he will have to consult local landscape architects and nurserymen.
- c. *Unit of Measure* used in lawn work is 1,000 sq. ft. This serves well since 3 cu. yds. of loose material are required to cover a thickness of approximately 1".
- d. *A Landscape Plan* always accompanies the Specifications Section on Lawns and Planting. This drawing indicates the location of lawn areas, edging strips, ground coverings, trees and shrubs, and should have a schedule identifying plants, usually by botanical as well as popular names, giving their height (and the spread when necessary), noting those to be balled and burlapped and other pertinent information.

#### 26-2 MATERIALS

- a. *Topsoil* to be obtained away from the site is often specified to be a fertile, friable, natural topsoil of loamy character, without admixture of subsoil material. It should contain decomposed organic matter and should be free from heavy clay, stones and other foreign materials. It should not be handled when frozen or in a muddy condition. Every effort should be made in the stripping and stockpiling the topsoil to conserve all possible organic matter such as sods and decaying vegetable matter.
- b. *Sawdust* is often specified to be well rotted, not less than 2 years nor more than 8 years old. Sawdust should not be spread when moist.
- c. *Fertilizer* is usually a commercial fertilizer. It may be specified to be a

complete fertilizer with nitrogen content derived from either organic or inorganic sources with a minimum of 6% nitrogen, 8% phosphoric and 6% potash available materials or 5% nitrogen, 10% phosphoric and 5% potash available materials. Sometimes it is specified to be delivered to the site in original containers bearing manufacturer's statement of guarantee.

- d. *Water* is generally specified to be furnished by the General Contractor until the property is occupied by the Owner, whereupon the water should be furnished by the Owner.
- e. *Edging Strips* between planting areas and lawn areas are sometimes specified for better jobs. These edging strips may be galvanized, corrugated or flat steel strips, approximately 4" wide painted with a coat of rust-inhibiting paint and supported by steel pins; or they may be specified to be of brick. Edging strips should be set in ground with approximately 1" showing.
- f. *Plants* are usually specified to be sound, healthy, vigorous, free from disease and insects. Plants should be reasonably symmetrical and typical for the variety and species, and as scheduled on the drawing. Plants should have sufficient fibrous feeding roots to permit satisfactory growth after planting. Plants should be balled and burlapped as noted in Schedule.

### 26-3 PREPARATION OF LAWN AND GROUND COVER AREAS

- a. *Topsoil*: This paragraph should state that the available topsoil has been spread over the lawn and ground cover areas as specified in the "Earth Work" section. When no topsoil is available and the cost is not too great a factor, the paragraph could call for topsoil to be brought to the site and spread for a depth of 4" over all lawn and ground cover areas.
- b. *Lime*: Since many grasses grow better in an alkaline soil, the specification may call for agricultural lime to be spread at the rate of 20 lbs. per 1,000 sq. ft. of lawn area. Lime is not required for Bermuda and some of the other types of grasses.
- c. *Sawdust*: If the existing topsoil is good or if it is specified that topsoil is to be brought in, sawdust need not be specified. Otherwise, it is often specified that a blanket of sawdust 2" thick be spread over all lawn and ground cover areas. This gives porosity and adds organic matter when mixed with the earth.
- d. *Fertilizer*: Over the topsoil (or the sawdust) a uniform coating of 6-8-6 or 5-10-5 commercial fertilizer should be applied uniformly at the rate of 25 lbs. to 30 lbs. per 1,000 sq. ft.
- e. *Loosening and Pulverizing*: It is often specified that these areas shall be

loosened and mixed to a depth of 4" to 6" and then pulverized and all stones and other solid objects removed.

*Note:* It is considered poor practice in describing this operation to mention the implements needed, such as harrows, discs, plows, rakes and the like. The nurseryman might have a better and more appropriate implement than the one specified.

#### 26-4 LAWNS

- a. Unless one merely starts mowing what may start growing on a site, the least expensive way to obtain a lawn is by seeding. The next better but more expensive way to obtain a lawn is by sprigging (or by a combination of seeding and sprigging) provided the type of grass desired lends itself to sprigging. The most expensive but fastest way to obtain a lawn is by sodding.
- b. *Seeding:* Since there are many new grass seed being developed and many combinations being specified, expert advice about seeding should be obtained at a local level. In the Georgia area, it is sometimes specified that Kentucky Fescue 31 should be sown at the rate of 5 to 10 lbs. per 1,000 sq. ft. along with unhulled Bermuda at the rate of 2 to 3 lbs. per 1,000 sq. ft. The lawn area should then be compacted by a lawn roller.
- c. *Sprigging:* Local advice should also be obtained about sprigging. In the Georgia area it is sometimes specified that Tif-Green Bermuda shall be sprigged in rows 10" (16") apart and 6" (12") in the row.
- d. *Sodding:* The quickest and best way to obtain a lawn is by sodding, but this is also the most expensive. Sometimes sodding is specified only for steep slopes, for edging beds or to be placed directly against the house to prevent soiling of wall surfaces by splashing. The sod should contain a good cover of the type of grass desired; it should be 1" to 2" thick and in rectangles of uniform width.
- e. *Maintenance:* Since maintenance may not be as expensive to the Owner, if done by him instead of by the forces of the nurserymen, it is often stipulated that areas where there is a good stand of grass shall be worked by the Owner by weeding, sickling, mowing, raking and watering as necessary.
- f. *Guarantee:* The nurseryman should guarantee a good stand of grass and areas not showing a satisfactory cover after grass starts growing should be fertilized and reseeded (or resprigged) without cost to the Owner.

#### 26-5 GROUND COVERS

Ground covers are often specified for areas where it is not desired to maintain a lawn. This is particularly desirable on earth banks which need covering to hold the soil and yet are difficult to mow. Ground covers include Honeysuckle, Ivy, Periwinkle, Ajug and the like.

## 26-6 PLANTING OPERATIONS

- a. The description of planting operations might include some or all of the following typical paragraphs:
- b. *Planting Pits* shall be at least 12" greater in diameter than spread of root ball. Depth of pit shall be at least 6" greater than depth of root mass or root ball but not less than 18". Plants spaced less than 4 ft. apart shall be planted in a common pit or plant bed.
- c. *Planting*: Plants shall be planted in an upright position, not less than 12" from planned location as indicated on the planting plan. When so directed, locations of plants may be changed sufficient distance to provide necessary clearance from unforeseen obstacles and utility lines.
- d. *Fertilizing*: All plant pits or beds shall be backfilled with topsoil with admixture of chemical fertilizer at the rate of 1 lb. per cu. ft. or minimum of 1 lb. per shrub. The outside edge of all plant pits or beds shall be ringed with a 1" to 3" mound of topsoil to form temporary water basin.
- e. *Mulching*: Ground surface between and around all plants shall be loosened, raked smooth and covered with a 3" mulch of pine-straw or other suitable mulching material, such as peat moss, sawdust or leaves.
- f. *Supporting*: Plants more than 6 ft. high shall be supported with stakes or guy wires in sufficient number and strength to support the plant in vertical position for at least two growing seasons.
- g. *Plant Boxes* shall receive a 2" layer of crushed stone 1" to 2" in size in the bottom and shall then be filled to within 2" of the top with topsoil.
- h. *Maintenance*: Plants shall be watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected until accepted. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit. Upon completion of planting and prior to acceptance, remove from the site excess soil and debris and repair any damage to structures resulting from planting operations.
- i. *Protection*: Protect all plant areas and plants against trespassers and damage at all times. If any plants are injured, they shall be treated or replaced. No work shall be executed in or over prepared plant areas or adjacent to planting without proper safeguard and protection.
- j. *Acceptance and Guarantee*: A final inspection of the work will be made after one full growing season (or June 1st) to determine the condition of plant material. All plant materials not in a healthy growing condition will be noted. At the beginning of the next planting season, all plants which have been so noted and which are still not in a healthy growing condition shall be removed from the site and replaced with plants of like kind and size in the same manner as specified for the original planting and at no cost to the Owner.



## CHAPTER 27

# Plumbing

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### 27-1 GENERAL

- a. *Plumbing Drawings* showing the runs and sizes of pipes are prepared by experienced engineers for large buildings, but for small jobs it is customary to show only the location of fixtures on the architectural drawings. It is left to the Plumbing Contractor to run the pipes according to his own calculations, as governed by the plumbing codes and ordinances and by the specifications. The Architect's plumbing specifications on the small job have to be explicit to make up for the lack of specific plumbing drawings.
- b. *Permits*: It should be stipulated in the plumbing specifications that the Contractor shall secure and pay for all permits and inspections required by law.
- c. *Plumbing Codes and Ordinances*: The plumbing specifications should state that plumbing work shall meet the requirements of all local codes or ordinances. If there is no such code or ordinance governing the locality of the proposed building, it should be specified that the plumbing work shall meet the requirements of the National Plumbing Code ASA No. A40.8 and this will save the specification writer the tedious job of having to write out many of the requirements covered by the plumbing codes and ordinances.
- d. *Excavation and Backfilling* for plumbing work should be done by the Plumbing Subcontractor. Therefore, a paragraph similar to the following should be included in the plumbing section of the specifications:

*"Excavation and Backfilling*: Excavation and backfilling necessary for the installation of plumbing system shall be done under this heading."

### 27-2 MATERIALS

The specification writer should study the local plumbing codes and ordinances to see if they adequately describe the types of material he proposes to

use. If those materials are not covered, they may be specified as follows:

1. "*Cast Iron Soil Pipe and Fittings* shall meet the requirements of ASTM Spec. A74, (or Fed. Spec. WW-P-401) coated, Extra Heavy for underground work and Standard Weight for all other work."
2. "*Threaded Cast Iron Pipe* shall meet the requirements of Fed. Spec. WW-P-356 and threaded cast iron pipe fittings shall meet the requirements of Fed. Spec. WW-P-491a. Pipe and fittings shall be coated or uncoated at Contractor's option."
3. "*Sewer Pipe* shall meet the requirements of ASTM Spec. C13 and shall be standard strength clay sewer pipe with salt glaze."
4. "*Farm Drain Tile* shall meet the requirements of ASTM Spec. C4 and shall be of 4" I.D. in 12" sections."
5. "*Steel Pipe* shall meet the requirements of Fed. Spec. WW-P-406 (ASTM Spec. A120). Fittings shall be threaded malleable iron (150 lbs.) and shall meet the requirements of Fed. Spec. WW-P-521c. Pipe and fittings for water shall be galvanized."
6. "*Copper Tubing* shall be seamless meeting the requirements of Fed. Spec. WW-T-799a, *Type M* for all piping above ground and *Type L* for all piping underground. Fittings shall be solder type of wrought copper." (Where water is hard specify *Type L* for all piping above ground and *Type K* for all piping underground.)
7. "*Brass Pipe* shall meet the requirements of ASTM Spec. B43 (Fed. Spec. WW-P-351). Fittings shall be screw type malleable pattern of red brass alloy."
8. "*Valves*: Gate valves shall meet the requirements of Fed. Spec. WW-V-54 and -58 and globe valves with Fed. Spec. WW-V-51a. Valves 2" and under shall have bronze bodies and valves 2½" and larger shall have cast iron bodies."
9. "*Caulking Lead* shall meet the requirements of Fed. Spec. QQ-L-156."
10. "*Sheet Lead* for flashing shall meet the requirements of Fed. Spec. QQ-L-201a."
11. "*Solder* shall meet the requirements of Fed. Spec. QQ-S-571c."
12. "*Wrought Iron Pipe* shall meet the requirements of ASTM Spec. A72 (Fed. Spec. WW-P-441b, Class A) and shall be threaded standard weight pipe."

### 27-3 DRAINAGE SYSTEM (Figure 27-1)

- a. The drainage system of a building consists of all pipe receiving the discharge from fixtures and conveying the discharge to the outside of the building. The drainage system includes the venting, traps and cleanouts in connection with this piping.

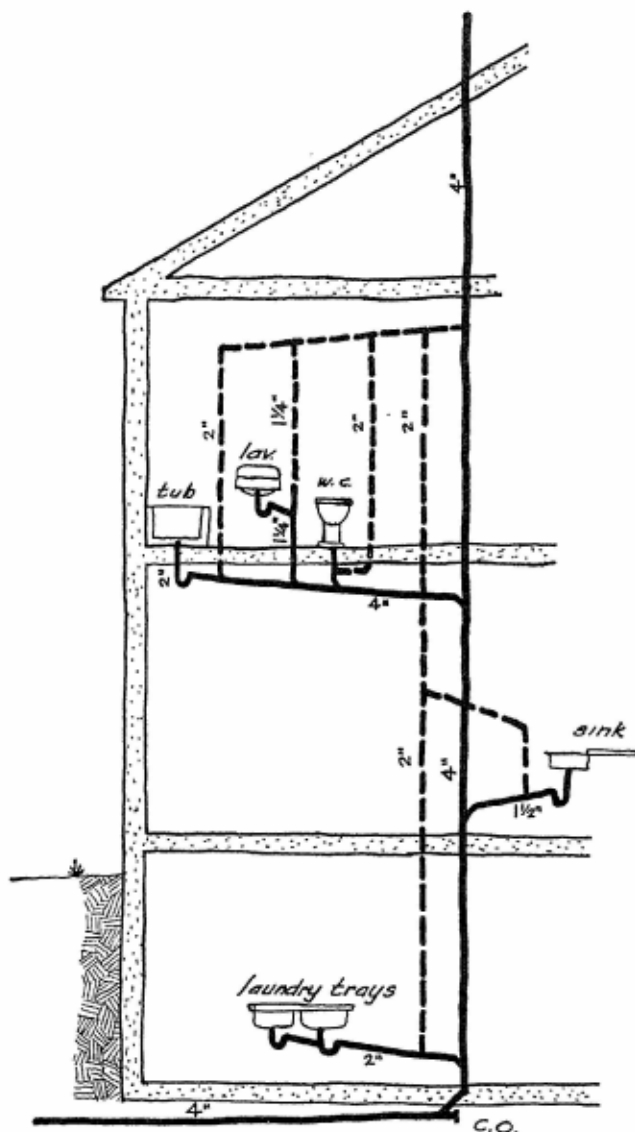


FIG. 27-1 DRAINAGE SYSTEM

b. *Soil Pipe* is any pipe receiving the discharge from water closets alone, or from water closets and other fixtures, and conveying the discharge to the house drain.

1. *Material* usually specified for soil pipe is extra-heavy cast iron soil pipe and fittings for pipe underground and standard weight cast iron

soil pipe and fittings for all other pipe. Threaded cast iron pipe and fittings and galvanized steel or wrought iron with galvanized drainage fittings may be specified for pipe above ground.

2. *Size of soil pipe* is usually 3" (or 4") for a residence, and plumbing codes and ordinances establish the size.
- c. *Waste Pipe* is any pipe receiving the discharge from fixtures other than water closets and conveying the discharge to soil pipe or house drain.
  1. *Material* specified for waste pipes is usually same as that specified for soil pipe, except chromium-plated brass pipe and fittings are specified for waste piping exposed at the fixtures.
  2. *Sizes* for residences are usually not less than 1¼" for lavatories, 1½" for sink and bathtub, 2" for laundry tray, shower and floor drain. Sizes need not be specified when plumbing codes and ordinances establish the sizes.
- d. *Vent* is any pipe provided to ventilate a house drainage system, to prevent trap syphonage and to equalize air pressure. Requirements for vents need not be included in plumbing specifications when the local plumbing codes or ordinances cover venting thoroughly. There are several methods of venting employed, known as: loop vent, circuit vent, yoke vent, bow vent and wet vent.
  1. *Material* specified for vent pipes is generally the same as the material specified for waste pipes.
  2. *Sizes* of vent pipes for residences are usually not less than 1¼" for lavatories, 1½" for sink, shower, bathtub and laundry tray and 2" for water closet. The sizes need not be specified when the plumbing code or ordinances require sizes similar to the ones mentioned.
- e. *Stack* is a general term for vertical soil, waste or vent pipe. It should be specified that stacks extending through the roof are to be made weather-proof with sheet lead, weighing not less than 4 lbs. (or 6 lbs.) per sq. ft., extend up 6" and out 8" fitted into coupling or turned down and caulked into a hub joint.
  1. If a special location is desired for the stacks where they penetrate the roof, it should be specified; for example:

"All stacks extending through the roof shall be run in the attic space to the rear of the roof ridge."
  2. *Size of stack* from water closets is usually not less than 3" (or 4").  
Sizes of stacks are also controlled by local codes and ordinances.
- f. *House Drain* is horizontal pipe receiving discharge from soil and waste pipes inside the walls of any building and conveying this discharge to the house sewer 5' to 10' outside the building.

1. *Material* generally specified for house drain is same as specified for soil pipe.
  2. *Size* of house drain for a residence is usually not less than 3" (or 4") and size need not be specified when plumbing codes and ordinances require size as mentioned.
- g. Trap* is any fitting constructed to prevent passage of air or gas through pipe, without materially affecting the flow of waste water or sewage.
1. *Material* should be same as material specified for pipe and fittings.
  2. *Sizes* for residences are usually not less than 1 1/4" for lavatory, 1 1/2" for sink, bathtub and laundry tray, and 2" for shower and floor drain. Sizes need not be specified when plumbing codes or ordinances require sizes similar to those mentioned.
- h. Cleanouts:* It should be specified that cleanouts (pipe fittings with removable caps affording access into pipe in case of stoppage) shall be provided as required by the local plumbing code or ordinances; cleanouts shall be located in accessible places and cleanouts in floors shall have countersunk caps.
1. *Material* need not be specified when the code or ordinance requires the cleanouts to be made of the same material as specified for the pipe and fittings, and cleanout plug or cap to be heavy brass, not less than 1/8" thick and provided with raised nut or recessed socket for removal.
  2. *Size* of cleanout should be same as the pipe it serves, up to 4", and not less than 4" for larger pipes.
  3. *Location* of cleanouts is controlled by the plumbing code or ordinances which usually require them to be located as follows:  
  
"At foot of each vertical waste or soil stack; and two in the house drain, one near base, and the other inside wall near house sewer."

If additional cleanouts are desired, one for each 30 ft. of 4" pipe or larger and one for each 20 ft. of 3" pipe or smaller, they should be specified.

#### 27-4 DRAINS

- a.* There are many different designs of drains to serve various purposes. Suitable drains should be selected from manufacturers' catalogs and specified by name and number. Several types used in residential construction are discussed below.
- b. Roof Drain* for flat roof, constructed of wood, concrete or precast slabs and surfaced with built-up roofing, should have a cast iron body, dome strainer and gravel stop with clamping ring. Outlet sizes are 2", 3", 4",

5" and 6". Select size from Table No. 19-1 under Plain Round Downspouts.

- c. *Promenade Deck Drain* for promenade roof construction of concrete, wood or precast slabs with waterproofing material below roof level to be bonded with drain should have cast iron body, brass frame and grate supported on brass collar to suit roof construction thickness, with clamping device for securely attaching waterproofing membrane. Outlet sizes are 2", 3", 4", 5" and 6". For usual condition minimum outlet size should be as indicated in Table No. 19-1 under Plain Round Downspouts.
- d. *Shower Stall Drain* should have cast iron body, clamping device, 2" outlet and 4" or 5" chromium plated brass adjustable strainer.
- e. *Basement Floor Drain* should be of cast iron body with sediment bucket, 3" outlet and cast iron grate.
- f. *Areaway Drain* should have cast iron body and sediment bucket, 2" outlet and cast iron grate.

#### 27-5 SEWAGE DISPOSAL

- a. *House Sewer* is pipe outside the walls of a building installed underground from the house drain to the main sewer in street or septic tank. It is pipe which conveys the drainage of one building site.
  - 1. *Material* usually specified is vitrified clay pipe as its cost is less than cast iron pipe. Cast iron should be specified when the house sewer is under pavement.
  - 2. *Size* should be specified to be one size larger than house drain, but in no case less than 4" (or 6").
- b. *Sewage Ejectors* should be called for in specifications of any building where the house drain or any portion of it is below the level of the sewer main.

#### 27-6 SEWAGE TREATMENT

- a. Where the site of a building is remote from any public sewer, a septic system must be installed to treat and dispose of the sewage. Such a septic system consists of the following:
  - 1. Grease Trap
  - 2. Septic Tank
  - 3. Absorption Field (Nitrification Field or Distribution Field)And for better type installations, in addition:
  - 4. Distribution Box
  - 5. Sludge Pit
- b. *Grease Trap*: Kitchen sink drainage should never be allowed to enter the septic tank except through a grease trap which should be installed

underground just outside of kitchen to interrupt the drainage from sink. One method of construction is to require walls and bottom of grease trap to be of concrete 4" thick and the top to be removable. Inside dimensions should be not less than 2' 6" length, 1' 6" liquid depth, 2' 6" depth and 1' 6" wide.

- c. *Septic Tank* is an underground tank on the property of any building receiving the sewage from the house sewer and promoting reduction of organic matter in the sewage. The septic tank should always be located on the downhill side and 50 ft. or more from any well. One method of construction requires top of septic tank to be constructed of removable concrete slabs 4" thick, with  $\frac{1}{2}$ " round iron lifts and reinforced with  $\frac{1}{2}$ " round bars 8" on centers. For size of tank and thicknesses of concrete walls, see Table 27-1.

TABLE 27-1. MINIMUM SIZE OF SEPTIC TANK  
AND MINIMUM LENGTH OF DRAIN TILE

Number of Persons	Inside Dimensions				Concrete Thickness			Length of 4" Drain		
	Length	Liquid Depth	Depth	Width	Walls	Top	Bottom	Sandy Soils	Med. Soil	Clay Soils
1 to 9	6'-0"	4'-0"	5'-0"	3'-0"	5"	4"	4"	200	350	550
10 to 14	7'-0"	4'-0"	5'-0"	3'-6"	5"	4"	4"	300	550	850
15 to 20	8'-0"	4'-0"	5'-0"	4'-0"	5"	4"	5"	400	800	1200

This table from "Septic Tank System for Suburban and Country Homes" by Georgia Department of Public Health.

- d. *Absorption Field* (sometimes called *Nitrification Field* or *Distribution Field*) is that portion of the septic system which receives the effluence and distributes it into the soil. The drain tile of the absorption field may branch off a main stem at 45 degree angles, or they may radiate from a junction box, or the line may snake back and forth, depending on the terrain. The absorption field should be indicated on the Plot Plan.
- e. Absorption field should be made of 4" farm drain tile laid with open joints on 1" x 3" grade board sloping not more than  $\frac{1}{4}$ " in 8 ft. Top of open joints should be covered with tar paper strips and gravel; crushed stone or washed cinder should be placed around drain tile at the rate of not less than 12" x 12" cross-sectional area. The trench to receive the drain tile should be not less than 12" wide at the bottom and a depth not less than 1' 10" nor more than 2' 10". Drain tile lines should be not less than 10 ft. apart. Top of the trench should be backfilled with earth. For lengths of drain tile, see Table 27-1.
- f. *Percolation Tests*: The better method of designing an absorption field

is to have a percolation test made at the site and base the calculations on the result as described in Chapter XI of FHA Minimum Property Standards.

## 27-7 STORM DRAINAGE

- a. Storm drainage is that portion of the plumbing system receiving rainwater and conveying it to a satisfactory disposal point. Specification writing will be simplified if the storm drainage lines are indicated on the Plot Plan.
- b. *Pickup*: The storm drainage pipe is connected to base of leaders collecting water from the roof areas to yard catch basins collecting water from yards and paved areas, to areaway drains or any other drains collecting rainwater.
- c. *Disposal*: Most cities will not allow the storm drainage to be connected to the house drain or house sewer as this overloads the sewage treatment plant. Other terminal points are:
  1. City Storm Sewer in street if available.
  2. Gutter of street, or gutter constructed on property.
  3. Paved driveway.
  4. Remote part of the property.
- d. *Material*: Storm drainage lines are usually of vitrified clay pipe and fittings for exterior lines and of same material specified for house drain if inside the building.
- e. *Sizes* of pipe for storm drainage lines may be computed by engineering principles. Under normal conditions pipe at  $\frac{1}{4}$ " pitch will drain the following areas:

4" pipe	2,650 sq. ft.
6" pipe	7,500 sq. ft.
8" pipe	16,000 sq. ft.
10" pipe	27,500 sq. ft.
- f. *Cast Iron Boots*: If the leaders of the building are to empty into a rainwater drainage system instead of emptying onto the ground, then a paragraph such as the following should be written:

"Cast Iron Boot shall be installed at the base of each leader and shall consist of cast iron pipe with *Extra-Heavy* cast iron  $\frac{1}{4}$  bend. Boot shall extend to a point 6" above the finish grade and each leader shall be cemented into the boot."
- g. *Catch Basins* for draining yards or paved areas are usually specified to be constructed of concrete slab and brick side walls and equipped with



light duty (medium duty) cast iron grating and frame (give size and manufacture).

## 27-8 WATER SUPPLY

a. *Water Service Pipe* is the pipe installed underground between the water main in the street (or other water source) and the building to be served.

1. *Material* generally specified for water service pipe is galvanized steel or wrought iron pipe in localities where the water is soft, and copper where the water is hard.
2. *Size* of water service pipe should be specified; the size should be computed by using exacting engineering principles, but for residences and the most usual conditions the size may be selected from Tables Nos. 27-2, 27-3, 27-4 and 27-5. In addition to 1 water closet, 1

TABLE 27-2. SIZE OF WATER SERVICE PIPE IN INCHES  
FOR RESIDENCE WITH ONE (1) BATHROOM

Size for galvanized iron pipe is given. Where figures are marked with asterisk one size smaller pipe may be used if copper pipe is specified.

Note: Several authorities recommend using not less than 1" pipe.

Length of Pipe (feet)	Pressure at the Main (Pounds Per Square Inch)							
	10	20	30	40	50	60	70	80
20	1*	¾	¾	¾	¾	¾	¾	¾
40	1¼*	1	1*	¾	¾	¾	¾	¾
60	1¼*	1	1	1*	¾	¾	¾	¾
80	1¼	1¼*	1	1	1*	¾	¾	¾
100	1¼	1¼*	1	1	1	1*	¾	¾
120	1¼	1¼*	1	1	1	1	1*	¾
140	1¼	1¼	1¼*	1	1	1	1	1*
160	1¼	1¼	1¼*	1	1	1	1	1
180	1¼	1¼	1¼	1¼*	1	1	1	1
200	1¼	1¼	1¼	1¼*	1	1	1	1

TABLE 27-3. SIZE OF WATER SERVICE PIPE IN INCHES  
FOR RESIDENCE WITH TWO (2) BATHROOMS

Size for galvanized iron pipe is given. Where figures are marked with asterisk one size smaller may be used if copper pipe is specified.

Length of Pipe (feet)	Pressure at the Main (Pounds Per Square Inch)							
	10	20	30	40	50	60	70	80
20	1¼*	1	1	1	1	1	1	1
40	1¼	1¼*	1	1	1	1	1	1
60	1¼	1¼	1¼*	1	1	1	1	1
80	1½*	1¼	1¼	1¼*	1	1	1	1
100	1½*	1¼	1¼	1¼	1¼*	1	1	1
120	1½*	1½*	1¼	1¼	1¼	1¼*	1	1
140	1½	1½*	1¼	1¼	1¼	1¼	1¼*	1
160	1½	1½*	1¼	1¼	1¼	1¼	1¼	1¼*
180	1½	1½	1½*	1¼	1¼	1¼	1¼	1¼
200	1½	1½	1½*	1¼	1¼	1¼	1¼	1¼

TABLE 27-4. SIZE OF WATER SERVICE PIPE IN INCHES  
FOR RESIDENCE WITH THREE (3) BATHROOMS

Size for galvanized iron pipe is given. Where figures are marked with asterisk one size smaller pipe may be used if copper pipe is specified.

Length of Pipe (feet)	Pressure at the Main (Pounds Per Square Inch)							
	10	20	30	40	50	60	70	80
20	1½*	1¼*	1	1	1	1	1	1
40	1½*	1¼	1¼*	1¼*	1	1	1	1
60	1½	1½*	1¼	1¼	1¼*	1	1	1
80	1½	1½	1½*	1¼	1¼	1¼*	1¼*	1
100	1½	1½	1½*	1¼	1¼	1¼	1¼	1¼
120	2*	1½	1½*	1¼	1¼	1¼	1¼	1¼
140	2*	1½	1½*	1¼	1¼	1¼	1¼	1¼
160	2*	1½	1½	1½*	1¼	1¼	1¼	1¼
180	2	2*	1½	1½*	1¼	1¼	1¼	1¼
200	2	2*	1½	1½	1½*	1¼	1¼	1¼

TABLE 27-5. SIZE OF WATER SERVICE PIPE IN INCHES  
FOR RESIDENCE WITH FOUR (4) BATHROOMS

Size for galvanized iron pipe is given. Where figures are marked with asterisk one size smaller may be used if copper pipe is specified.

Length of Pipe (feet)	Pressure at the Main (Pounds Per Square Inch)							
	10	20	30	40	50	60	70	80
20	1¼	1¼*	1¼*	1	1	1	1	1
40	1½*	1¼	1¼	1¼*	1¼*	1¼*	1	1
60	2*	1½*	1¼	1¼	1¼	1¼	1¼	1¼
80	2*	1½	1½*	1¼	1¼	1¼	1¼	1¼
100	2	2*	1½	1½*	1¼	1¼	1¼	1¼
120	2	2*	1½	1½	1½*	1¼	1¼	1¼
140	2	2*	1½	1½	1½	1½*	1¼	1¼
160	2	2	2*	1½	1½	1½	1½*	1¼
180	2¼*	2	2*	1½	1½	1½	1½	1½*
200	2¼*	2	2*	1½	1½	1½	1½	1½

basin and 1 bath for each bathroom, the tables allow for 1 sink, 1 laundry tray and 2 lawn faucets. The tables are based on using tank type water closets instead of flush valves. If flush valves are used, select pipe one size larger, and the pressure in the main should be at least 30 lbs.

- b. *Tap and Meter:* Tap for the water service pipe at the street main is generally one size smaller than the service pipe. Connection and installation of meter is usually made by the City.
- c. *Water Softener:* In localities where the water has high content of calcium and magnesium sulfates and bicarbonates, known as hard water, it is necessary to specify water softening equipment. The hard cold water is usually run to the water closets, kitchen sink, lavatories, hose bibbs and lawn hydrants and the soft hot and cold water run to the other fixtures.

## 27-9 WATER DISTRIBUTION (Figure 27-2)

- a. Water distributing pipes are pipes conveying water from the water service pipe to the plumbing fixtures. Material generally specified for the water distributing pipes is same as specified for the water service pipe, except the exposed pipe connections and fittings near each fixture are usually specified to be chromium-plated brass. The water distributing pipes may be subdivided as follows:
- b. *Supply Main* is that portion of the water distributing pipes carrying water from the water service pipe to the supply branches and risers. It should be specified that the supply main connection to the water service

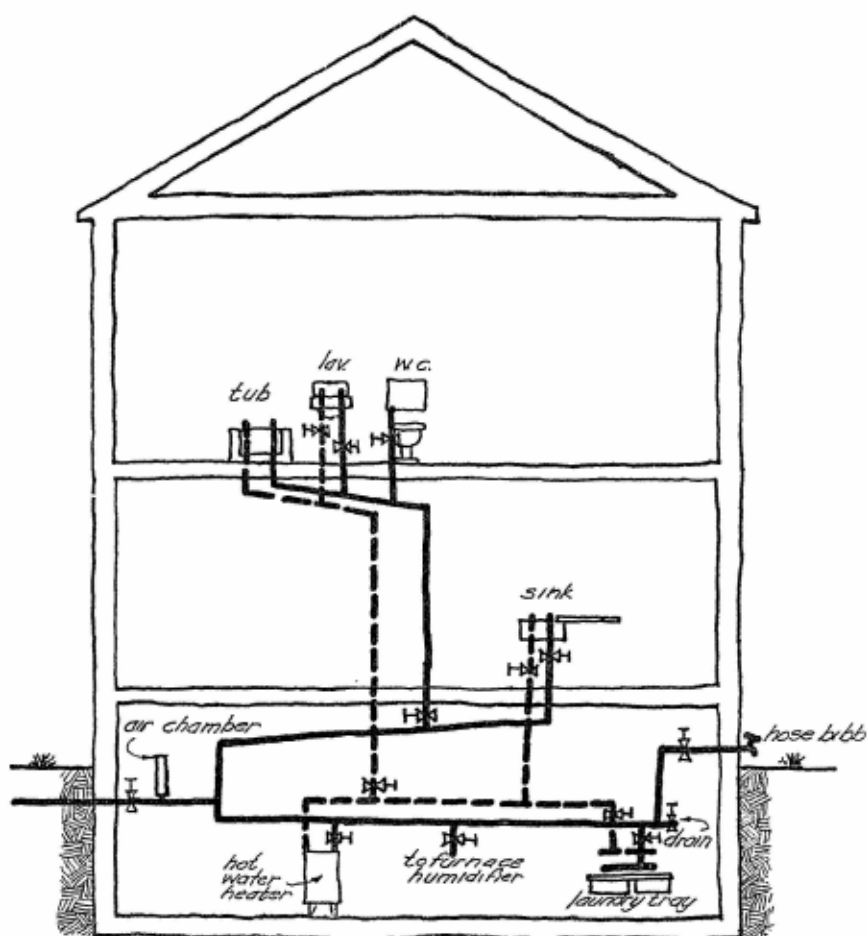


FIG. 27-2 WATER DISTRIBUTION

pipe shall be the same size as the water service pipe and may be reduced in size as branches and risers are taken off.

- c. *Supply Branches and Risers* are that portion of the water distribution pipes delivering water from the supply main to the fixtures. It should be specified that supply branches or risers to each bath or toilet shall be not less than  $\frac{3}{4}$ " (or 1"). Sizes of these pipes to single fixtures of a residence are usually not less than  $\frac{3}{8}$ " to lavatories and water closet tanks,  $\frac{1}{2}$ " to laundry trays, sinks, bathtubs and hose bibbs,  $\frac{3}{4}$ " to hot water boiler and 1" to flush valves. If sizes are required by plumbing codes or ordinances, they need not be mentioned in this specification.
- d. *Outlet for Attaching Humidifier Line:* It should be noted in the specifications if such an outlet is to be provided to supply the humidifier of a warm air furnace.
- e. *Air Chamber:* An air chamber is specified for better class work to cushion surge within the supply lines. It usually consists of a piece of 6" pipe 24" high, capped and provided with an air cock. The air chamber is installed on the main cold water supply near its entrance into the building (on house side of reducing valve, if there is one). It is installed vertically and connected to the supply with a pipe and gate valve same size as the supply. A  $\frac{1}{4}$ " drain with cock should be provided at the bottom of the air chamber.
- f. *Hose Bibbs* are installed in foundation walls of houses for attaching water hose. They are usually indicated on the drawings, and there should be at least two hose bibbs for each house; one on front wall and one on rear wall. Hose bibbs should be of brass with handle and  $\frac{3}{4}$ " hose connection and should be connected with  $\frac{1}{2}$ " (or  $\frac{3}{4}$ ") supply line.
- g. *Yard Hydrants* may be indicated near garden and lawn areas for attaching water hose and may be specified as follows:

"Yard Hydrants shall be compression type, hand-operated, self-closing of nonfreezing construction with automatic drain and brass mounted parts,  $\frac{3}{4}$ " inlet and  $\frac{3}{4}$ " hose thread. Install where indicated on Plot Plan and connect with  $\frac{3}{4}$ " supply line and place not less than 4 cu. ft. of stone or gravel under the drain. The automatic drain shall be below the frost line."

## 27-10 VALVES

- a. There are two types of valves generally used in connection with water distribution systems:
  - 1. *Gate Valves:* These valves do not interrupt the direct flow of water and should be used at all locations where there are continuous runs of pipe. It should be specified that gate valves shall be of the wedge type with double seat.

2. *Globe Valves*: The disc of these valves can be removed easily and replaced, which is an advantage. These valves reduce the water flow.
- b. *Material*: Bodies of valves 2" or less should be brass or bronze and bodies of valves 2½" or more may be iron; all valves should be rated for 125 lbs. steam working pressure.
- c. *Location of Valves*: A gate valve should always be specified for the cold water supply main just inside the building wall; near this gate valve there should be installed a ¾" globe or gate valve and a suitable drain leg to empty the entire system into the house drainage system.
- d. A gate valve should always be specified for the cold water feed branch to the hot water tank, and a check valve should be provided in the hot water return line to the hot water tank. Both should be located as near the tank as possible.
- e. For the best class of work, gate valves are specified for each hot and cold water riser to be installed in an accessible place and generally at the base of the riser. It is also specified that a drip or drain cock shall be installed near each of these gate valves to empty the riser.
- f. *Stop Valves* installed in hot and cold water connections to each fixture are a great convenience when repair work is to be done on the fittings of the fixtures. These stop valves are always specified for the best class of work.
- g. *Pressure Reducing Valves* should be called for in the specifications when the pressure in the street main is above 50 lbs. The pressure reducing valve should be installed in water supply main near point of entry to reduce pressure to 50 psi.
- h. *Flush Valves* are efficient devices used for flushing water closets (and urinals) and are recommended for large commercial and industrial jobs for the following reasons:
1. Operate at 10-second intervals.
  2. Cannot readily be tampered with.
- For residential work the tank is better for the following reasons:
1. Noise caused by flush valve operation is objectionable.
  2. Two features mentioned above are not important factors for residential work.

## 27-11 HOT WATER SUPPLY

- a. The automatic storage type hot water heaters are probably used more than any other type of water heating system for residences, whereas the direct type hot water storage system is often used for buildings such as apartments and hotels requiring large quantities of hot water.
- b. *Automatic Storage Type Water Heaters* may be specified for small resi-

dences, and for usual conditions the size may be selected from Table 27-6. The specification should state whether it is to be gas-fired, oil-fired

TABLE 27-6. MINIMUM SIZE OF AUTOMATIC STORAGE TYPE WATER HEATERS

<i>No. of Occupants Residence*</i>	<i>Occupants Office Building</i>	<i>Max. Hr. H.W. Demand</i>	<i>Av. Hr. H.W. Demand</i>	<i>BTU Input Rating</i>	<i>Recov. Gals. per hr. **</i>	<i>Nominal Size in Gals.</i>
2	4	6.7	2.8	16,000	20.0	15
3	6	10.05	4.2	20,000	20	20
4	8	13.40	5.6	25,000	26	30
5	10	16.75	7.0	30,000	30	40
6	12	20.10	8.4	40,000	32	50
7	14	23.45	9.8	50,000	52	60
8	16	26.80	11.2	75,000	79	75
9	18	30.15	12.6	75,000	79	75
10	20	33.50	14.0	75,000	79	100
11	22	36.85	15.4	100,000	105	100
12	24	40.20	16.8	100,000	105	100

\* Residence or small apartment buildings.

\*\* 80 degree rise.

or electric. The tank may be specified to be galvanized steel (glass-lined steel complying with CS 115, copper or monel), insulated with not less than 1" mineral wool or glass fiber. Tanks of galvanized steel shall be equipped with magnesium rod for protection against electrolytic action. Water heater should be thermostatically controlled and completely enclosed in a steel jacket with baked-on enamel finish. Connect heater to sleeve in flue with vent pipe (omit if electric heater, and change "vent pipe" to "smoke pipe" if oil-fired).

- c. *Direct Type Hot Water Storage System* may be specified for larger installations consisting of a hot water boiler and a tank. The specification should include the type of firing (gas, oil or coal) and the equivalent hot water radiation of the boiler. Boiler should be equipped with governor and control valve, boiler drain, insulated metal jacket and draft hood.
  1. *Storage Tanks* are usually specified to be of steel "extra heavy" weight, welded, riveted or both. Tanks of 120 gals. or less should be galvanized and installed vertically on stand. Tanks over 120 gals. should be given a coat of protective paint and installed horizontally on pipe supports. If nonferrous tanks are specified, they should meet the requirements of the specification of the Non-Ferrous Water Tank Manufacturers Association, Inc. The tank should be equipped with temperature bulb gland, water pressure relief valve and tank thermometer. Size of tank should be computed and given.
  2. *Covering for Hot Water Storage Tank:* A nonconductive covering should be specified for the hot water storage tank; this is usually

specified to be plastic type containing not less than 85% magnesium and not less than  $1\frac{1}{4}$ " thick. The final coat should be mixed half and half with portland cement and finished smooth.

#### 27-12 HOT WATER DISTRIBUTING PIPES

Hot water distributing pipes are pipes conveying hot water from the water supply to all fixtures requiring hot water. Materials for hot water distribution are generally the same as specified for cold water distribution. The specification paragraph covering this work usually states that hot water supply pipes shall be run from hot water source to all fixtures except water closets. For best performance a  $\frac{1}{2}$ " circulating line operating on a gravity principle should be specified to assure immediate supply of hot water at any fixture.

#### 27-13 PIPE COVERING

Pipe covering is not usually required for the cold water lines unless they are in an exterior wall or some other exposed location where they might freeze even with heat in the building. For the best class of work, insulation is specified for the hot water lines, the covering to be sectional wool felt, not less than  $\frac{3}{4}$ " thick, with canvas jacket and lacquered steel bands 18" o.c.

#### 27-14 GAS PIPING

- a. Gas piping, if required, should be specified in the *Plumbing* section of the specifications.
- b. *Material* generally specified is steel or wrought iron pipe with malleable screw type fittings.
- c. *Sizes*: See Table No. 27-7.
- d. *Cocks*: A main gas cock should be installed just inside the building.
- e. *Installation*: Supply pipe should be brought to the building underground. Gas meter is usually furnished and installed by the local gas company.

#### 27-15 INSTALLATION OF PIPING

- a. If the local plumbing codes and ordinances cover the following requirements for the installation of pipes, the paragraphs covered may be omitted by the specification writer.
- b. *Piping Underground*: Top of clay sewer pipe should be run not less than 24" below grade and top of water pipe or cast iron sewer pipe should be run not less than 16" \* below grade. Pipe must be firmly bedded on solid ground.
- c. *Piping Above Ground* should be run parallel with the lines of the build-

\* This is minimum depth for pipes in southern localities where the frost line is less than 16"; pipe in northern localities should be run deeper; see Figure 12-1.

TABLE 27-7. SIZE OF GAS PIPING BRANCHES

<i>Size of Branch (in.)</i>	<i>Capacities (cu. ft./hr.)</i>
$\frac{1}{2}$ .....For runs 15' and under.....	Not more than 75
$\frac{3}{4}$ .....	From 75 to 117
1.....	From 117 to 216
$1\frac{1}{4}$ .....	From 216 to 426
$1\frac{1}{2}$ .....	From 426 to 625
2.....	From 625 to 1175
$2\frac{1}{2}$ .....	From 1175 to 1823
3.....	From 1823 to 3150

*Note:* Maximum cubic foot demand for:

Domestic Range—	62.5 cu. ft. Natural Gas
	118.0 cu. ft. Manufactured Gas
Refrigerator—	3.9 cu. ft. Natural Gas
	7.4 cu. ft. Manufactured Gas
Dryer—	18 cu. ft. Natural Gas
	34 cu. ft. Manufactured Gas

To find cubic foot per hour required for other equipment, divide Btu value by 1,000 for natural gas, by 800 for mixed gas and by 530 for manufactured gas.

ing. Pipes must be supported to prevent sagging.\* Stack should be supported at base. All supports should be of permanent nature.

- d. *Grade:* Horizontal soil and waste pipes should be run with a minimum grade of  $\frac{1}{4}$ " per ft.
- e. *Changes in Direction* of soil and waste lines should be made by means of Y's and  $\frac{1}{6}$ ,  $\frac{1}{8}$  and  $\frac{1}{4}$  bends.
- f. *Reduction in Size of Pipe* should be made with reducing fittings.
- g. *Reaming:* All pipe after cutting should be reamed and have burrs removed.
- h. *Concealing Pipe:* All pipe above the basement should be concealed in partitions and above ceilings of all finished areas. Pipe in basement and areas under wood floor joists may be run exposed.

## 27-16 PIPE JOINTS

The local plumbing codes and ordinances may cover requirements for pipe joints; if so, the specification writer may omit part or all of the following:

1. "Joints for Cast Iron Soil Pipe shall be caulked joints, firmly packed with oakum or hemp and secured with lead. Poured lead joints shall entirely fill the pipe hub and no joint shall be less than 1" deep, and must be well caulked."
2. "Joints in Clay Sewer Pipe shall be made with yarn dipped in cement which shall be caulked into all hubs, and face of joint shall be filled with 1:2 portland cement mortar and trowelled smooth."

\* If special type hangers at definite intervals are required, so specify.



3. "*Screw Joints* shall be American Standard screw joints and made with suitable joint compound applied to the male thread only. Pipe shall be screwed up to the shoulder of the fittings."
4. "*Slip Joints*: No slip joints or coupling joints will be permitted except on fixture side of traps."

#### 27-17 TESTS

Tests need not be required by the specification when plumbing codes or ordinances require tests similar to the following:

1. "*Water Piping* shall be tested under water pressure equal to, or greater than, the pressure for which the system is designed. Pressure shall remain constant for not less than 15 minutes." (For best type of work, sometimes this test is specified to be 50% in excess of working pressure.)
2. "*Soil and Waste Pipes* shall be tested with not less than 10 ft. head of water. Pressure shall remain constant for not less than 15 minutes."
3. "*Air Tests*: In occupied finished buildings where water might cause damage, air tests may be substituted for water tests. Pressure of air for drain-age system test shall be not less than 5 pounds."

#### 27-18 CONNECTIONS TO EQUIPMENT

- a. It is often specified that the Plumbing Contractor shall make hot water, cold water and drain connections to the following equipment to be furnished by the Owner:

Dishwasher  
Garbage Eliminator  
Washing Machine

- b. When the kitchen sink is purchased by the Owner along with the kitchen cabinets, it should be included in the list.

#### 27-19 PLUMBING FIXTURE SCHEDULE

The specification writer should select the plumbing fixtures from one reputable manufacturer's catalog and name two or more reputable manufacturers whose fixtures will be considered, if comparable list is submitted to Architect for approval. For each type of fixture the list should include:

Number to be furnished  
Type of fixture  
Manufacturer's plate number  
Trade name of fixture  
Material and finish

---

- Type and size of supply pipe
- Whether or not stops will be required
- Size and type of trap
- Other requirements

It is usually specified that all fittings and trim shall be chromium plated. Lead or other type shower pans should be included in the list for all showers except showers over tubs.

## CHAPTER 28

# Heating

---

### 28-1 GENERAL

a. There are many ways to heat a residence and the principal types include:

- |                            |   |
|----------------------------|---|
| 1. Fireplaces              | 7. Forced warm air system (Figure 28-1) |
| 2. Circulating heaters     | 8. Gravity hot water system             |
| 3. Pipeless furnaces       | 9. Forced hot water system              |
| 4. Floor furnaces          | 10. One pipe steam systems              |
| 5. Space heaters           | 11. Two pipe steam systems              |
| 6. Gravity warm air system | 12. Panel radiant system                |

b. The fuels used in heating include electricity, coal, gas and oil.

c. To limit the scope of this chapter only the forced warm air heating system (often called "winter air conditioning") fired by gas or oil is included. The reasons for the selection of this heating system for residential work are:

1. One blower can circulate air for most small and moderate-sized residences,
2. Air is circulated,
3. Air is filtered,
4. Humidity is controlled,
5. Entire system has quick pickup,
6. Cost of adding cooling is reduced.

### 28-2 GENERAL REQUIREMENTS

a. *Regulations:* All work should be done in strict accordance with the rules and regulations of the Board of Fire Underwriters, State, County and local building laws and ordinances, and in accordance with the Manuals issued by the National Warm Air Heating and Air Conditioning Association.

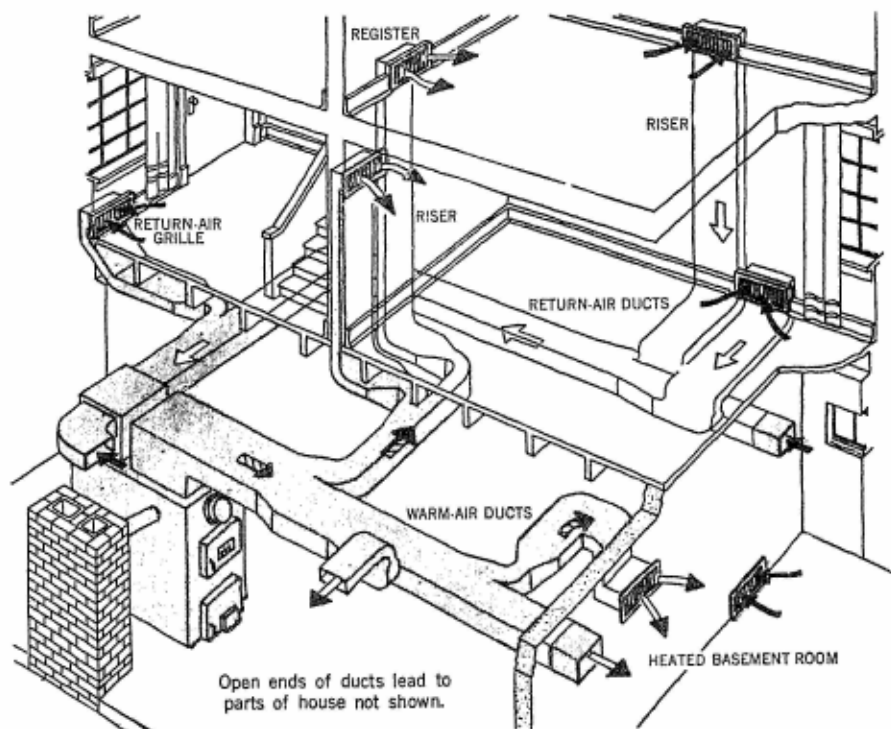


FIG. 28-1 FORCED WARM-AIR SYSTEM

- b. *Permits:* This Contractor should make all applications for permits and should pay all fees required by law. He should give to the proper authorities all required notices relating to his work.
- c. *Service:* Contractor should be required to furnish necessary service free of charge for 90 days during actual use of the system.
- d. *Excavation and Backfilling* for installation of oil tank and oil piping, if required, should be done under this heading.

### 28-3 HEATING SYSTEM

- a. The type of heating system should be described in a paragraph similar to the following:

"Heating system shall be oil-fired (gas-fired) forced warm air, automatically supplying sufficient humidity to the air, circulating the air at least 5 times per hour while operating, and thoroughly cleaning the air. System shall be guaranteed to maintain an indoor temperature of 70 degrees F. at sitting level 30" above floor throughout the building when the external temperature is \_\_\_\_\_ degrees F."

- b. The external temperature which should be added in the blank space provided in the typical paragraph above is the average minimum low temperature of the locality where the system is to be installed. (See Figure 28-2.)

#### 28-4 FURNACE LOCATIONS

Location of furnace is often shown on drawings and need not be mentioned in the specifications. This location should be near the center of the building and in the basement, preferably, although furnace may be at floor level or in attic. The furnace room should have free area opening of 25 sq. in. per 100,000 Btu furnace input and a minimum free area opening of 25 sq. in.

#### 28-5 HEAT LOSS

- a. Since experienced heating and ventilating engineers are usually not available for very small jobs, it falls upon the Architect to establish the requirements and restrictions for a small building such as a residence. The Architect should at least give the Btu heat loss in each area of the building by computing it and scheduling it or placing the figures on the plans in the appropriate areas.
- b. Heat loss for each area in the building may be computed by using the following form:

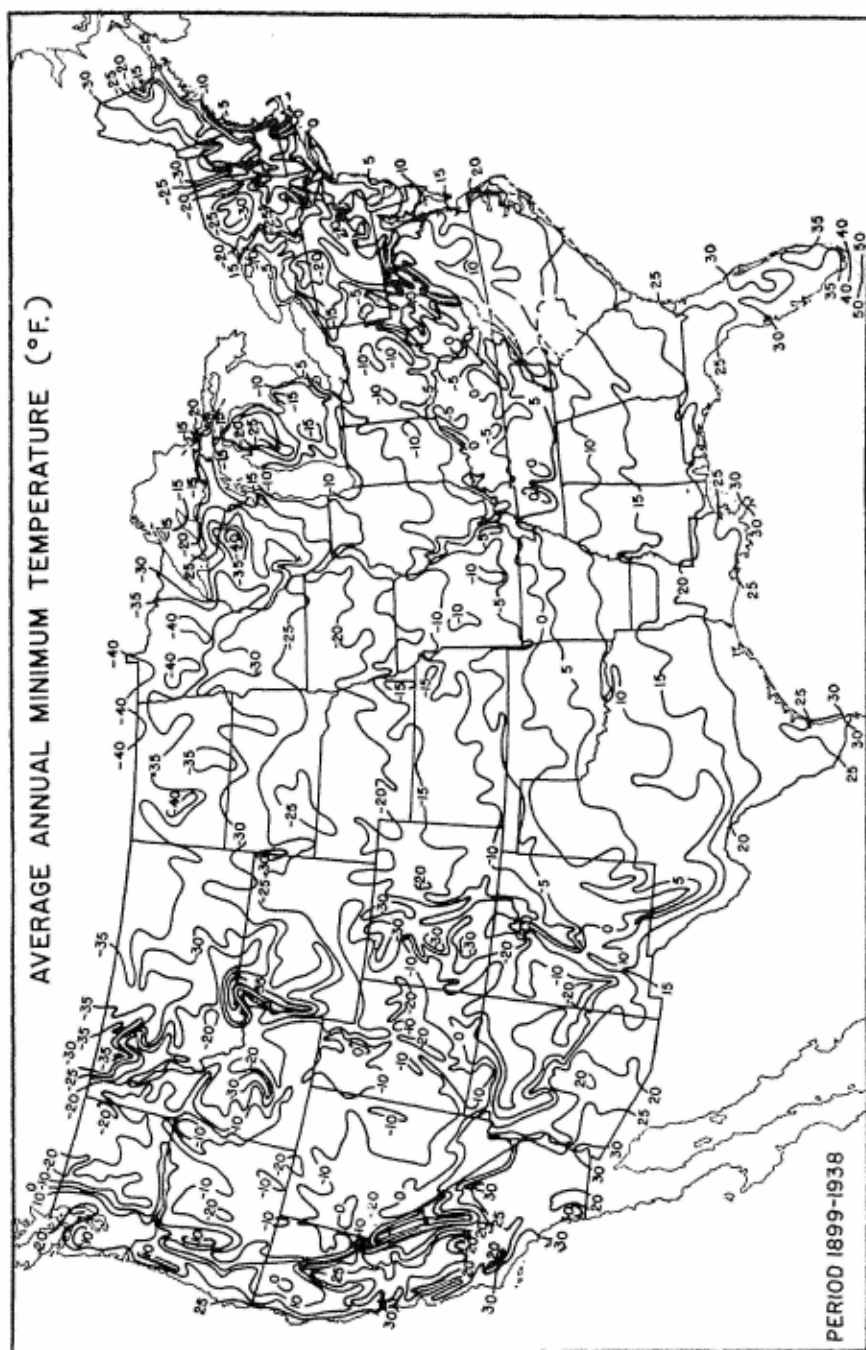
Name of Area _____			
Walls above grade	_____ sq. ft.	x _____ *	= _____
Walls below grade**	_____ sq. ft.	x _____ *	= _____
Glass area	_____ sq. ft.	x _____ *	= _____
Ceiling	_____ sq. ft.	x _____ *	= _____
Skylight	_____ sq. ft.	x _____ *	= _____
Floor	_____ sq. ft.	x _____ *	= _____
Infiltration of air	_____ lin. ft.	x _____ *	= _____
TOTAL HEAT LOSS BTU/HR			_____

#### 28-6 LAYOUT DRAWINGS

The sizing and layout of duct work is often left to the Contractor and he should be required to furnish drawings before the building is framed, for the Architect's approval. These drawings should show the location and size

\* Select factors from Tables 28-1 and 28-2 in the proper column representing the difference between inside temperature of 70 degrees F. and the average minimum low temperature for the locality of the building.

\*\* Walls below grade are walls in contact with ground.



From "Climate and Man," Yearbook of Agriculture, 1941, U.S. Dept. of Commerce

FIG. 28-2

of all duct work, supply registers and return grilles. Location of thermostat should be shown.

#### 28-7 AREAS TO BE HEATED

The areas to be heated should be designated and usually include all finished areas except possibly Closets, Storage Rooms and Garage. It is often specified that return air ducts shall be provided for all areas except Bath Rooms and Kitchen.

#### 28-8 FURNACE

a. A typical paragraph describing the furnace is as follows:

"Furnace shall be a unit with insulated casing containing combustion chamber, blower, motor, humidifier, burner, controls, filters, heat-accelerated thermostat, safety controls, pump (substitute "pilot light" for "pump" when furnace is gas-fired) and draft diverter, Btu input rating of furnace shall be \_\_\_\_\_ and minimum blower cfm shall be \_\_\_\_\_ at 65 degrees F. based on 100 degrees F. temperature rise through the unit."

b. For filling in the two spaces above determine the total heat loss of the house by adding the heat loss of all areas as computed by method described in Paragraph 28-5 b above. Using the total figure for column 1, select the Btu input size of unit from column 2 and the minimum cfm for blower from column 3 of Table 28-3.

#### 28-9 SMOKE PIPE

The Contractor is generally required to connect the furnace to sleeve in the flue with metal smoke pipe (change words "smoke pipe" to "vent pipe" if unit is gas-fired).

#### 28-10 SUMMER SWITCH

A summer switch should be specified for the blower independent of all other controls to permit the blower to be used in summer time for air circulation.

#### 28-11 HUMIDIFIER

Humidifier should be specified to be capable of evaporating 0.015 lb. of water per M Btu per hr. of input, under continuous operating conditions. Connections should be made to water line and a shut-off valve provided.

#### 28-12 FILTERS

Filters usually specified are fireproofed "throw-away" type.

## 28-13 THERMOSTAT

A thermostat should be specified to be located on the inside wall of a room responsive to changes in outside temperatures, and one of the following three types should be called for:

Plain room thermostat

Manually wound automatic reset control thermostat



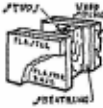

Automatic electric clock control thermostat

TABLE 28-1. BTU HEAT LOSS

## METHOD FOR DETERMINING B. T. U. HEAT LOSS FROM ROOM

The heat loss in B. t. u. per hour should be determined for each room to be heated.

FOR ANY GIVEN LOCALITY, USE ONLY THE HEAT LOSS FACTORS SHOWN IN THE COLUMN OF DESIGN TEMPERATURE DIFFERENCE FOR THAT LOCALITY. The varying temperature differences for walls below grade, interior partitions, basement floors, and floors over unheated spaces have all been provided for in the design temperature column which you select for the building. The user is instructed to mark off the column to be used for his locality, so that reference to the proper column can be more readily made.

DESCRIPTION	Heat Transmission Coefficient U	HEAT LOSS FACTOR (Multiply values shown by exposed areas in sq. ft.)										
		Design Temperature Difference, deg. F.										
		40	50	60	65	70	75	80	85	90	100	110
 Window	<b>WINDOWS</b>											
	No. 1											
	(a) Glass, single	1.13	45	57	68	73	79	85	90	95	102	113
	(b) Same as (1a) with tight fitting storm sash	0.45	18	23	27	29	32	34	36	38	41	45
 Door	(c) Storm sash put up and taken down annually will probably be loose fitting. Under such conditions, recommend using	0.75	30	38	45	49	53	56	60	64	68	75
	No. 2											
	(a) Doors are figured the same as though they were windows (See No. 1)											
 Frame	<b>EXPOSED WALLS</b>											
	No. 3 Frame											
	(a) Frame, wood siding, paper, sheathing, lath and plaster	0.25	10	13	15	16	18	19	20	21	23	25
	(b) Same as (3a) substituting 1/2" rigid insulation for lath	0.10	8	10	11	12	13	14	15	16	17	19
	(c) Same as (3a) with 1/2" flexible insulation between studs in contact with sheathing	0.17	7	9	10	11	12	13	14	15	17	19
	(d) Same as (3c) with two air spaces	0.15	6	8	9	10	11	12	13	14	15	17
	(e) Same as (3a) with 2" blanket or bat insulation between studs	0.12	5	6	7	8	8	9	10	10	11	12
	(f) Same as (3a) with 3 1/2" mineral wool or equivalent between studs	0.09	4	5	5	6	6	7	7	8	8	9
	(g) Same as (3a) substituting 1 1/2" rigid insulation for wood sheathing	0.19	8	10	11	12	13	14	15	16	17	19
	(h) Same as (3a) with composition siding over wood siding	0.21	8	11	13	14	15	16	17	18	19	21
	(i) Same as (3a) substituting asphalt or asbestos shingles for wood siding	0.30	12	15	18	20	21	23	24	26	27	30
	(j) Same as (3b) substituting 1/2" rigid insulation for lath	0.22	9	11	13	14	15	17	18	19	20	23
	(k) Same as (3h) with 1/2" flexible insulation between studs in contact with sheathing	0.19	8	10	11	12	13	14	15	16	17	19
	(l) Same as (3j) with two air spaces	0.17	7	9	10	11	12	13	14	14	15	17
	(m) Same as (3h) with 2" blanket or bat insulation between studs	0.12	5	6	7	8	8	9	10	10	11	12
	(n) Same as (3h) with 3 1/2" mineral wool or equivalent between studs	0.09	4	5	5	6	6	7	7	8	8	9
 Leaky Frame	<b>No. 4 Leaky Frame</b>											
	(a) Clapboards or wood siding, studs, lath and plaster	1.00	40	50	60	65	70	75	80	85	90	100
	(b) Tongue and grooved tight siding (without sheathing or paper) studs, lath and plaster	0.50	20	25	30	33	35	38	40	43	45	50
	(c) Same as (4a) with composition siding over wood siding	0.28	11	14	17	18	20	21	23	24	25	28
	(d) Corrugated sheet metal siding on studs	2.00	80	100	120	130	140	150	160	170	180	200

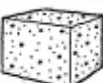



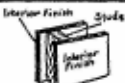
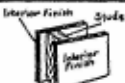


(Many of these illustrations have been reproduced from A.S.H.V.E. Guide by permission.)



TABLE 28-1.—Continued

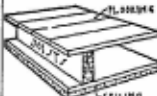


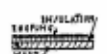
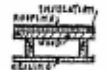
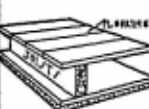
DESCRIPTION	U	HEAT LOSS FACTOR (Multiply values shown by exposed area in sq. ft.)										
		Design Temperature Difference, deg. F.										
		40	50	60	65	70	75	80	85	90	100	
<b>No. 5 Brick</b>												
(a) 8" Brick wall—plain	0.50	20	25	30	33	35	38	40	43	45	50	
(b) Same as (5a) plastered on one side	0.46	18	23	28	30	32	35	37	39	41	46	
(c) Same as (5a) furred, lath and plaster one side	0.30	12	15	18	20	21	23	24	26	27	30	
(d) Same as (5a) substituting ½" rigid insulation for the lath	0.22	9	11	13	14	15	17	18	19	20	22	
<b>No. 6 Brick</b>												
(a) 12" Brick wall—plain	0.36	14	18	22	23	25	27	29	31	32	36	
(b) Same as (6a) plastered on one side	0.34	14	17	20	22	24	26	27	29	31	34	
(c) Same as (6a) furred, lath and plaster one side	0.24	10	12	14	16	17	18	19	20	22	24	
(d) Same as (6a) substituting ½" rigid insulation	0.19	8	10	11	12	13	14	15	16	17	19	
<b>No. 7 Brick and Tile or Block</b>												
(a) 4" Brick and 8" Hollow Tile or Cinder Block	0.34	14	17	20	22	24	26	27	29	31	34	
(b) Same as (7a) plastered on one side	0.33	13	17	20	21	23	25	26	28	30	33	
(c) Same as (7a) furred, lath, and plaster	0.24	10	12	14	16	17	18	19	20	22	24	
(d) Same as (7a) substituting ½" rigid insulation for lath	0.18	7	9	11	12	13	14	14	15	16	18	
(e) 4" Brick and 8" Concrete Block	0.44	18	22	26	29	31	33	35	37	40	44	
<b>No. 8 Brick Veneer</b>												
(a) Brick veneer—4" brick, paper, wood sheathing, studs, lath and plaster	0.27	11	14	16	18	19	20	22	23	24	27	
(b) Same as (8a) substituting ½" rigid insulation for lath	0.20	8	10	12	13	14	15	16	17	18	20	
(c) Same as (8a) with 2" blanket or bat insulation between studs	0.12	5	6	7	8	8	9	10	10	11	12	
(d) Same as (8a) with 3½" mineral wool or equivalent between studs	0.09	4	5	5	6	6	7	7	8	8	9	
(e) Same as (8a) substituting ½" rigid insulation in place of wood sheathing	0.21	8	11	13	14	15	16	17	18	19	21	
<b>No. 9 Tile and Stucco</b>												
(a) 8" Hollow Tile—plain stucco exterior	0.40	16	20	24	26	28	30	32	34	36	40	
(b) Same as (9a) plastered	0.38	15	19	23	25	27	29	30	32	34	38	
(c) Same as (9a) furred, lath and plaster	0.26	10	13	16	17	18	20	21	22	23	26	
(d) Same as (9c) substituting ½" rigid insulation for lath	0.20	8	10	12	13	14	15	16	17	18	20	
<b>No. 10 Tile and Stucco</b>												
(a) 12" Hollow Tile—plain stucco exterior	0.30	12	15	18	20	21	23	24	26	27	30	
(b) Same as (10a) plastered	0.29	12	15	17	19	20	22	23	25	26	29	
(c) Same as (10a) furred, lath and plaster	0.22	9	11	13	14	15	17	18	19	20	22	
(d) Same as (10c) substituting ½" rigid insulation for lath	0.17	7	9	10	11	12	13	14	14	15	17	
<b>No. 11 Block</b>												
(a) 8" Cinder Block—plain (Also Haydite)	0.42	17	21	25	27	29	32	34	36	38	42	
(b) Same as (11a) plastered	0.39	16	20	23	25	27	29	31	33	35	39	
(c) Same as (11a) furred, lath and plaster	0.27	11	14	16	18	19	20	22	23	24	27	
(d) Same as (11c) substituting ½" rigid insulation for lath	0.20	8	10	12	13	14	15	16	17	18	20	
<b>No. 12 Block</b>												
(a) 8" Concrete Block—plain	0.56	22	28	34	36	39	42	45	48	50	56	
(b) Same as (12a) plastered	0.52	21	26	31	34	36	39	42	44	47	52	
(c) Same as (12a) furred, lath and plaster	0.32	13	16	19	21	22	24	26	27	29	32	
(d) Same as (12c) substituting ½" rigid insulation for lath	0.24	10	12	14	16	17	18	19	20	22	24	
(e) Same as (12a) basement wall, below grade	*	2	2	3	3	4	4	5	5	5	6	
(f) 12" concrete block, above grade	0.50	20	25	30	33	35	38	40	43	45	50	
(g) 12" concrete block, below grade	*	2	2	3	3	4	4	5	5	5	6	

TABLE 28-1.—Continued

DESCRIPTION	U	HEAT LOSS FACTOR (Multiply values shown by exposed area in sq. ft.)									
		Design Temperature Difference, deg. F.									
		40	50	60	65	70	75	80	85	90	100
 Concrete	No. 13 Concrete										
	(a) 8" Concrete wall, above grade	0.70	28	35	42	46	49	53	56	60	70
	(b) 8" concrete wall, below grade	*	2	2	3	3	4	4	5	5	6
	(c) 12" concrete wall, above grade	0.58	23	29	35	38	41	44	46	49	58
	(d) 12" concrete wall, below grade	*	2	2	3	3	4	4	5	5	6
 Stone	No. 14 Stone										
	(a) 8" Limestone or Sandstone—plain	0.91	28	36	43	46	50	53	57	60	71
	(b) Same as (14a) plastered on one side	0.84	26	32	38	42	45	48	51	54	64
	(c) Same as (14a) furred, lath and plaster	0.37	15	19	22	24	26	28	30	31	37
	(d) Same as (14c) substituting 1/2" rigid insulation for lath	0.25	10	13	15	16	18	19	20	21	25
	(e) 12" limestone, below grade	*	2	2	3	3	4	4	5	5	6
	(f) 12" limestone, below grade	*	2	2	3	3	4	4	5	5	6
 Glass	No. 15 Stone										
	(a) 12" Limestone or Sandstone—plain	0.58	23	29	35	38	41	44	46	49	58
	(b) Same as (15a) plastered on one side	0.53	21	27	32	34	37	40	42	45	53
	(c) Same as (15a) furred, lath and plaster	0.23	13	17	20	21	23	25	26	28	33
	(d) Same as (15c) substituting 1/2" rigid insulation for lath	0.23	9	12	14	15	16	17	18	20	23
 Stud Plaster	No. 16 Glass Block										
	(a) 3 1/4" Glass Block	0.49	20	25	29	32	34	37	39	42	49
	FRAME INTERIOR PARTITIONS										
	No. 17 Finish One Side										
	(a) With lath and plaster one side; other side open	0.62	12	16	19	20	22	23	25	26	31
 Interior Finish Studs	(b) Same as (17a) substituting 1/2" rigid insulation for lath	0.35	7	9	11	11	12	13	14	15	18
	(c) Same as (17a) with 1/2" rigid insulation on opposite side	0.25	5	6	8	8	9	9	10	11	13
	(d) Same as (17a) with 2" blanket or bat insulation between studs	0.12	3	4	5	5	6	6	7	8	10
	(e) Same as (17a) with 3 1/2" mineral wool insulation or equivalent	0.09	4	4	5	5	6	7	7	8	9
	No. 18 Finish Both Sides										
 Interior Finish Studs	(a) With lath and plaster both sides	0.34	7	9	10	11	12	13	14	14	17
	(b) Same as (18a) substituting 1/2" rigid insulation for lath	0.18	4	5	5	6	6	7	7	8	9
	CEILING WITH ATTIC SPACE ABOVE										
	No. 19 No Floor										
	(a) Lath and plaster, no floor above (No attic vent)	0.32†	14	18	21	22	24	26	27	29	34
 Joist Ceiling With Roof Above	(b) Same (Ventilated attic)	0.61*	24	30	37	40	43	46	49	52	61
	(c) Same as (19a) substituting 1/2" rigid insulation for lath (No attic vent)	0.29†	10	13	15	16	17	18	20	21	24
	(d) Same (Ventilated attic)	0.35*	14	17	21	23	25	26	28	30	35
	(e) Same as (19a) with 1/2" rigid insulation on top of joists (No attic vent)	0.18†	8	10	12	13	14	14	15	16	19
 Joist Ceiling With Roof Above	(f) Same (Ventilated attic)	0.25*	10	12	15	16	18	19	20	21	25
	(g) Same as (19b) with 2" blanket or bat insulation between joists	0.12*	5	7	8	8	9	10	10	11	13
	(h) Same as (19b) with 3 1/2" mineral wool or equivalent between joists	0.09*	4	5	6	6	7	7	8	8	10
	FOR CEILING PANEL HEATING										
	(i) Same as (19h)		7	8	9	10	10	11	11	12	13

\* Where basement depth is 3' or less below grade, use above grade factor.


TABLE 28-1.—Continued

DESCRIPTION	U	HEAT LOSS FACTOR (Multiply values shown by exposed areas in sq. ft.)											
		Design Temperature Difference, deg. F.											
		40	50	60	65	70	75	80	85	90	100		
 With Roof Above	No. 20 With Floor												
	(a) Lath and plaster with tight floor above (No attic vent)	0.20†	9	11	13	14	15	16	17	18	19	21	
	(b) Same (Ventilated attic)	0.38*	11	14	17	18	20	21	22	24	25	28	
	(c) Same as (20a) substituting ½" rigid insulation for the lath (No attic vent)	0.10†	7	9	10	11	12	13	14	14	15	17	
	(d) Same (Ventilated attic)	0.21*	8	10	13	14	15	16	17	18	19	21	
	(e) Same as (20a) with 2" blanket or bat between joists	0.11*	5	6	7	8	8	9	9	10	11	12	
(f) Same as (20a) with 3½" mineral wool or equivalent between joists	0.09*	4	5	6	6	7	7	8	8	9	10		
 Steel Ceiling With Roof Above	No. 21 Steel												
	(a) Steel ceiling, no floor above (No attic vent)	0.35†	16	19	23	25	26	28	30	32	33	37	
	(b) Same (Ventilated attic)	0.70*	30	37	45	49	52	56	60	64	67	75	
	(c) Same as (21a) with floor above (No attic vent)	0.23†	10	12	14	15	17	18	19	20	21	23	
	(d) Same (Ventilated attic)	0.31*	12	15	19	20	22	23	25	26	28	31	
	(e) Same as (21a) or (21b) with 2" blanket or bat insulation between joists	0.12*	5	7	8	8	9	10	10	11	12	13	
(f) Same as (21a) or (21b) with 3½" mineral wool or equivalent above	0.09*	4	5	6	6	7	7	8	8	9	10		
CEILING—PART OF ROOF—NO ATTIC SPACE													
No. 22													
 No Attic Space	(a) Lath and plaster, rafter, sheathing, shingles	0.29	13	16	19	20	22	23	25	26	28	30	
	(b) Same as (22a) substituting ½" rigid insulation for the lath	0.21	9	12	14	15	16	17	18	19	20	22	
	(c) Same as (22a) with 2" blanket or bat insulation between joists	0.12	5	7	8	8	9	10	10	11	12	13	
	(d) Same as (22a) with 3½" mineral wool or equivalent between rafters	0.09	4	5	6	6	7	7	8	8	9	10	
FLAT ROOFS WITH BUILT UP ROOFING AND FLAT METAL ROOFS WITH 1" BOARDS													
No. 23 No Ceiling													
 Flat Roof No Ceiling	(a) Wood 1" thick without ceiling, and with no insulation	0.49	22	27	32	34	37	39	42	44	47	51	
	(b) Wood 1" thick without ceiling, but with ½" rigid insulation (No air space)	0.23	13	15	18	20	21	22	24	25	27	29	
	(c) Same as (23a) with 2" blanket or bat insulation between joists	0.12	5	7	8	8	9	10	10	11	12	13	
	(d) Same as (23a) with 3½" mineral wool or equivalent between joists	0.09	4	5	6	6	7	7	8	8	9	10	
	(e) Corrugated sheet metal on rafters	2.00	90	110	130	140	150	160	170	180	190	210	
No. 24 With Ceiling													
 Flat Roof With Ceiling	(a) Wood 1" thick with lath and plaster ceiling, and no insulation	0.32	14	18	21	22	24	26	27	29	30	34	
	(b) Same as (24a) with ½" rigid insulation instead of lath	0.23	10	13	15	16	17	18	20	21	22	24	
	(c) Wood 1" thick with lath and plaster ceiling, and with ½" rigid insulation	0.21	9	12	14	15	16	17	18	19	20	22	
	(d) Same as (24a) with 2" blanket or bat insulation between joists	0.12	5	7	8	8	9	10	10	11	12	13	
	(e) Same as (24a) with 3½" mineral wool or equivalent between joists	0.09	4	5	6	6	7	7	8	8	9	10	
WOOD FLOORS OVER UNHEATED SPACES THAT ARE ENCLOSED (Either crawl spaces or basement rooms)													
No. 25													
 Floor	(a) Double floor on joists	0.34	5	7	9	9	10	11	12	13	14	15	
	(b) Same as (25a) with lath and plaster ceiling	0.25	4	6	7	8	8	9	9	10	11	12	
	(c) Same as (25a) with ½" rigid insulation on bottom of joists	0.19	3	4	5	5	6	6	7	7	8	9	
	(d) Same as (25a) with sheathing on bottom of joists and 2" bat insulation between joists	0.12	2	3	3	4	4	4	5	5	5	6	
	(e) Same as (25a) with sheathing on bottom of joists and 3½" mineral wool or equivalent between joists	0.09	2	2	2	3	3	3	3	4	4	4	

†The combined coefficients for ceilings with attic spaces above, include the resistances to heat flow imposed by both the ceiling construction and the roof construction.

\*Ceiling coefficient used. Factors are based on attic temperature being same as outdoor temperature.

TABLE 28-1.—Continued

DESCRIPTION	U	HEAT LOSS FACTOR (Multiply values shown by exposed areas in sq. ft.)										
		Design Temperature Difference, deg. F.										
		40	50	60	65	70	75	80	85	90	100	
WOOD FLOORS OVER SPACES EXPOSED TO OUTDOOR TEMPERATURES												
Some As Above	No. 26											
	(a) Same as (25a)	0.54	12	15	19	20	22	24	26	27	29	32
	(b) Same as (25b)	0.26	9	11	14	15	16	18	19	20	21	24
	(c) Same as (25c)	0.19	7	9	10	11	12	13	14	15	16	19
	(d) Same as (25d)	0.12	4	5	7	7	8	8	9	10	10	11
	(e) Same as (25e)	0.09	3	4	5	5	6	6	7	7	8	9
CONCRETE FLOORS												
	No. 27											
	(a) Concrete floors, in basement, in contact with ground		1	1	2	2	2	2	4	4	6	
	(b) Concrete floors for basementless houses		2	2	3	5	7	8	10	12	13	17
	(c) Reinforced concrete floor over crawl space	0.65	10	13	16	18	20	22	23	25	26	30

## Notes

1. The heat transmission coefficient, U, is the B. t. u. heat loss per hour per square foot of surface per degree difference between the air temperature on the heated and unheated sides of the surface.
2. The HEAT LOSS FACTOR (Nos. 1 to 27) is the B. t. u. per hour per square foot of surface, and is the product of the coefficient, U, and the appropriate temperature difference.
3. The heat loss factor for Walls No. 4a and 4d, (Page 22) and Ceiling No. 23e (Page 26) which are exceedingly poor and leaky constructions, are composed of the transmission loss of the construction itself, together with a loss due to air leakage through the construction.
4. The following temperatures were used, in accordance with best prevailing practice:  
Ceiling air temperature of 75 deg. F.

Living zone air temperature of 70 deg. F.  
Air temperature above floor of 65 deg. F.

Temperature differences of enclosed, unheated spaces adjoining a heated space are based on temperatures existing in that space.

Ground temperatures, 5 feet below the surface, considered as equal to 70 deg. and 40 deg. for outside design temperature of 30 deg. and -30 deg., respectively. Intermediate values of ground temperatures were assigned to design temperature differences between these two extremes.

Ground temperatures for walls below grade considered as midway between outdoor air temperature and temperature of ground 5 feet below surface.

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## 28-14 AIR VELOCITIES

Air velocities for this type of heating system are usually specified not to exceed the following:

Main trunk	700 to 900 fpm
Branch ducts	600 fpm
Wall stacks	500 fpm
Low registers, horizontal delivery	300 fpm

## 28-15 AIR DUCTS

- a. Air ducts for risers should be specified to be not lighter than 28 gauge galvanized iron or equivalent, and gauges for plenum chambers and trunks should be not less than:

Gauge	Width	Seam	Reinforced Seam
28	Up to 12"	1"	————
26	13" to 18"	1"	————
24	19" to 30"	1"	1/8" x 1"
22	31" to 60"	1 1/2"	1/8" x 1 3/8"
20	61" to 90"	1 1/2"	1/8" x 1 3/8"

TABLE 28-2. INFILTRATION FACTORS

INFILTRATION FACTORS BY CRACKAGE METHOD  
(Multiply Infiltration Factors for Construction Nos. 28 to 32 by "Running Feet of Crack")

DESCRIPTION	C.F.H. Per Foot Crack	INFILTRATION FACTOR (Multiply values shown by running feet of crack)									
		Design Temperature Difference, deg. F.									
		40	50	60	65	70	75	80	85	90	100
<b>WINDOWS</b>											
<b>No. 28—Double-Hung, Wood Sash Windows</b>											
(a) Average fit, not weatherstripped	39	28	35	42	45	50	53	57	60	65	70
(b) Average fit, weatherstripped or equipped with storm windows	24	17	20	25	28	30	32	34	36	38	42
(c) Poor fit, not weatherstripped	111	80	100	120	130	140	150	160	170	180	200
(d) Poor fit, equipped with storm windows	34	25	30	35	40	43	46	50	52	55	62
(e) Wood casement hinged	111	80	100	120	130	140	150	160	170	180	200
(f) same as (e) weatherstripped or with storm sash	55	40	50	60	65	70	75	80	85	90	100
(g) Fixed or Picture windows	14	10	13	15	16	18	19	20	21	23	25
<b>No. 29—Double-Hung, Metal Windows</b>											
(a) Not weatherstripped	72	52	65	75	85	90	95	105	110	120	130
(b) Weatherstripped	32	25	30	35	37	40	43	45	50	55	60
<b>No. 30—Rolled Section, Steel Sash Windows</b>											
(a) Industrial pivoted	176	125	160	190	205	220	240	255	270	285	315
(b) Architectural projected (also steel basement sash)	88	65	80	95	105	110	120	130	135	145	160
(c) Residential Casement	52	35	45	55	60	65	70	75	80	85	95
(d) Heavy casement section	38	25	35	40	45	48	50	55	60	65	70
<b>No. 31—Hollow Metal Windows</b>											
(a) Vertically pivoted window	145	105	130	155	170	185	195	210	220	235	260
<b>DOORS</b>											
<b>No. 32—Residential and average service</b>											
(a) Well fitted door, not weatherstripped	111	80	100	120	130	140	150	160	170	180	200
(b) Poorly fitted door, not weatherstripped	222	160	200	240	260	280	300	320	340	360	400
(c) Door, weatherstripped or with tight storm door	55	40	50	60	65	70	75	80	85	90	100
(d) Doors frequently opened, as in stores	550	240	300	360	390	420	450	480	510	540	600
<b>No. 33—Swinging Doors and Revolving Doors</b> (multiply the following Infiltration Factors by the average number of persons entering building during period of one hour in severe weather.)											
	C.F.H. Per Person										
(a) Swinging doors	160	110	135	165	175	190	200	215	230	245	270
(b) Swinging doors leading into vestibule	111	80	100	120	130	140	150	160	170	180	200
(c) Revolving doors (if used in cold weather)	88	65	80	100	105	115	120	130	140	145	160
<b>Manual 9 No. 34—Ventilation Factors</b> B.t.u.—C.f.m. x Factor											
		43	54	65	70	76	81	86	92	97	108

FOR ANY GIVEN LOCALITY, USE ONLY THE INFILTRATION FACTORS SHOWN IN THE COLUMN OF DESIGN TEMPERATURE DIFFERENCE FOR THAT LOCALITY.

## Notes

1. INFILTRATION FACTORS for infiltration loss (Nos. 28 to 32) are in terms of the B. t. u. loss per lineal foot of crackage per hour, and are the product of the air leakage per foot of crack per hour, the density of room air, the specific heat of air, and the appropriate temperature difference.
2. INFILTRATION FACTORS for infiltration loss (No. 33) are in terms of the B. t. u. per person entering the door, and are the product of the air leakage past the door per person entering the door, the density of room air, the specific heat of air, and the appropriate temperature difference.

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TABLE 28-3. SELECTION OF PROPER SIZE GAS WINTER AIR CONDITIONER

<i>Heat Loss of House BTU/Hr.</i>	<i>Size of Unit BTU Input</i>	<i>Minimum Blower Cfm at 65° F.</i>	<i>Heat Loss of House BTU/Hr.</i>	<i>Size of Unit BTU Input</i>	<i>Minimum Blower Cfm at 65° F.</i>
10,000	16,000	117	90,000	141,000	1,035
20,000	32,000	234	95,000	149,000	1,090
30,000	48,000	351	100,000	156,000	1,144
35,000	56,000	410	110,000	171,000	1,254
40,000	64,000	468	120,000	186,000	1,360
45,000	72,000	528	130,000	200,000	1,465
50,000	79,000	579	140,000	215,000	1,575
55,000	87,000	638	150,000	230,000	1,685
60,000	95,000	696	160,000	244,000	1,790
65,000	103,000	756	170,000	258,000	1,890
70,000	110,000	806	180,000	272,000	1,990
75,000	118,000	865	190,000	286,000	2,090
80,000	125,000	915	200,000	300,000	2,200
85,000	133,000	975			

Source: *Reference Manual of Modern Gas Service* by the American Gas Association.

- b. The duct system should be designed to meet established standards for air delivery and quiet operation, and volume dampers should be installed in each branch.

## 28-16 REGISTERS AND GRILLES

Supply registers and return grilles are often specified to be wall type. Registers should be equipped with operating dampers and gaskets. The design of registers and grilles should be selected and specified by manufacturers' trade names or numbers. Registers and grilles should be installed as close to the floor as possible.

## 28-17 ELECTRICAL CONNECTIONS

The Heating Contractor should be required to make all electrical connections directly from the electric panel.

## 28-18 OIL TANK AND OIL PIPING

The oil tank and the oil piping for the heating system may be specified in the Heating section to keep from dividing responsibility for the entire system. Size and location of tank should be given.

## 28-19 GAS PIPING

If the heating unit is gas-fired, the gas piping is generally specified in the *Plumbing* section; see Chapter 27.

## 28-20 SUMMER AIR CONDITIONING

- a. Summer air conditioning is being used more and more in residential work. In many warm areas of the country almost all of the moderately priced residences are equipped with summer air conditioning either by window units or a central system.
- b. *Principle of Summer Air Conditioning* as usually employed can be explained briefly as follows: A refrigerant such as Freon 12 or 22 is compressed into a liquid by a compressor and stored in a condenser. As this is done, the heat created has to be removed from the condenser by means of water or air cooling (or a combination of both known as an evaporative condenser). The compressed refrigerant is then allowed to expand in the coils of a conditioner and this removes heat from air passing over these coils. This cool air is transmitted to the areas of the building to be provided with summer air conditioning. Means to control the humidity to a certain extent and to filter the air are also provided.
- c. *Heat Gain Calculation:* For a summer air conditioning system to be designed properly, the rate at which the heat flows and is released within a structure has to be determined. This is known as *heat gain* and is expressed in *Btuh*, British thermal units per hour. To calculate this heat gain is much more complicated than to determine the *Btu* heat loss for a heating system. Many factors have to be taken into consideration: the location of the structure (humid areas, average humidity areas or dry areas), design temperature difference between dry bulb and wet bulb temperatures, whether or not the exterior materials are dark or light, the orientation of exterior surfaces, whether or not windows are shaded or exposed and sensible heat and latent heat generated in the structure as well as heat gained by air leakage.
- d. *Reference Material:* One of the best simplified manuals on Heat Gain Calculation for Summer Air Conditioning is Manual No. 11, price \$1.50, published by the National Warm Air Heating and Air Conditioning Association, 640 Engineers Building, Cleveland 14, Ohio. This manual can be used for determining not only the size of the unit required but also the size of ducts and registers. Unless complete air condition drawings are provided, the *Btuh* heat gain for each area should be given on the architectural plans.
- e. *Areas to be Cooled* should be designated, and, the same as for *Heating*, these usually include all finished areas except possibly Closets, Storage Rooms and Garage. It is often specified that return air ducts shall be provided for all areas except Bath Rooms and Kitchen.
- f. *Air Conditioning Unit:* If a package type air conditioning unit is desired, the model and make of the unit should be specified; the *Btuh*

capacity should be given (or the tons of cooling capacity which is the *Btuh* divided by 12,000); the compressor motor horsepower, the condenser fan horsepower and the blower fan horsepower should be noted; the *cfm* capacity should be stated and the electrical characteristic listed.

- g. *Thermostat*: The type of thermostat should be selected and specified with its location given. All the control wiring to the unit should be provided.
- h. *Air Ducts* are specified the same as noted for *Heating*. If the ducts are to be used for both summer and winter air conditioning, they should be designed primarily to handle the summer air conditioning requirements.
- i. *Insulation of Air Ducts*: Where ducts are located in attics or crawl spaces, the supply ducts should be wrapped with 2" of insulation and the return ducts with 1" of insulation. This insulation is often specified to be of flexible glass fiber faced with aluminum foil providing a positive vapor barrier. Insulation should be securely taped around ducts and at all joints and made vaporproof.
- j. *Registers and Grilles* are specified the same as noted for *Heating* except when registers are located at baseboard height; diffusing type supply registers blanketing the outer wall areas with conditioned air should be specified. These diffusing type registers are suitable for both summer and winter air conditioning.
- k. *Testing and Balancing*: The Contractor should be required to test and properly balance the system and guarantee the entire system against faulty materials or workmanship for one year following completion and acceptance.



## CHAPTER 29

# Electrical

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### 29-1 GENERAL

- a. *Drawings* (Figure 29-1): For large jobs the Architect always has an experienced electrical engineer design the electrical system and prepare the drawings indicating all circuits and the location of all switches, outlets, equipment and panels. For small residences the Architect usually has to prepare his own electrical drawings and these generally show only the location of outlets and the switch controls. The arrangement of circuits is left to the Contractor's judgment under the limitations and requirements of electric codes and the specifications.
- b. *Permits and Inspection*: It is customary to require the Contractor to obtain and pay for all permits and inspection fees required for the electrical work and to present to the Architect for the Owner all certificates of inspection from all authorities having jurisdiction.
- c. *Codes*: The specifications should warn the Contractor that the installation of the electrical system shall meet the requirements of The National Electric Code and all local codes and regulations.
- d. *Excavation and Backfilling*: If the electric service is to be installed underground, it is customary to require the excavation and backfilling necessary for the installation of underground wire and cables to be done by the Electrical Contractor.
- e. *Materials*: It is sometimes stated in electrical specifications that materials shall be listed by the Underwriters' Laboratories, Inc., as conforming to its standards in every case where such a standard has been established for the particular type of material.

### 29-2 TYPES OF WIRING (Figure 29-2)

- a. The specification writer should check the local code and regulations before specifying the types of wiring; certain types permitted by the National Electric Code are not allowed by some of the local codes and regulations. It is usually required that all wiring in finished areas shall be run concealed and that no wiring shall be placed on top of framing members. Wiring specifications should include the following:

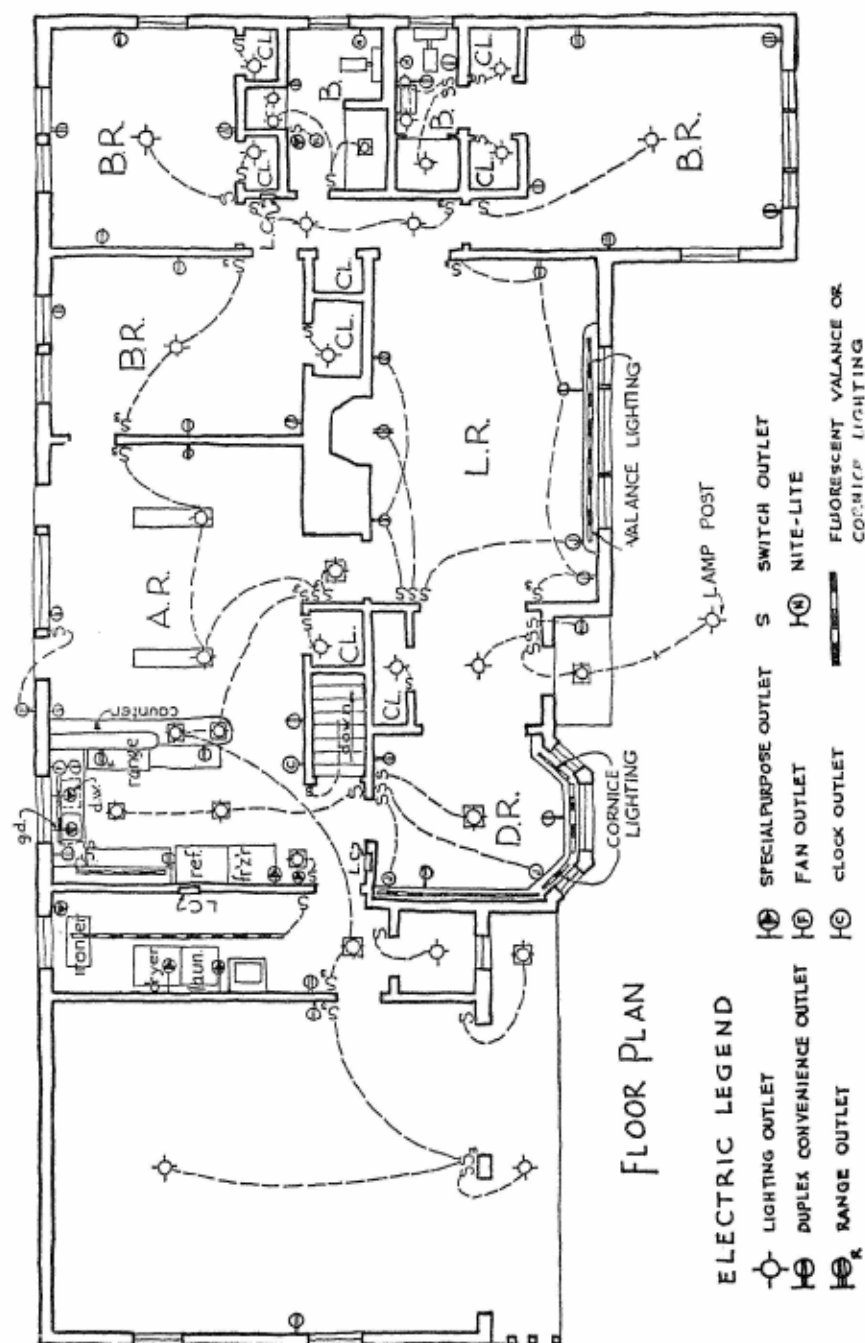


FIG. 29-1 LOCATION OF OUTLETS AND SWITCH CONTROLS

- b. "Service Entrance Conductors for Overhead Service from service head to main distribution center should be insulated conductors installed in rigid metal conduit."

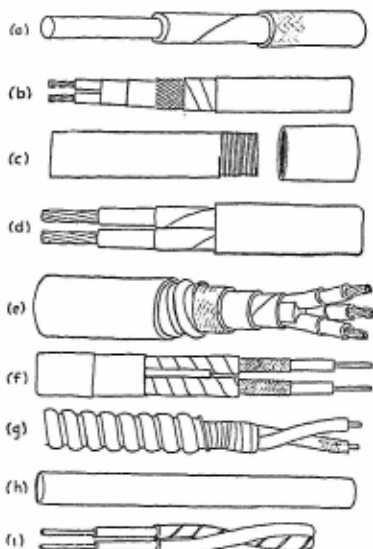


FIG. 29-2 TYPES OF WIRING. (a) Insulated conductor. (b) Service entrance cable. (c) Rigid conduit. (d) Lead-covered cable. (e) Lead-covered and steel-armored cable. (f) Non-metallic sheathed cable. (g) Armored cable. (h) Electric metallic tubing. (i) Braided rubber-insulated wire.

1. Alternate specification is to require insulated conductors in electric metallic tubing.

2. Alternate specification is to require service entrance cable.

- c. *Underground Service Entrance Conductors* (and for underground circuit to garage and outside lighting of play areas) should be lead-covered cable in rigid metal conduit.

1. Alternate specification is to require lead-covered cable in tile or fiber duct.

2. Another alternate is to require lead-covered and steel-armored cable.

3. Alternate specification also may require suitable nonmetallic underground cable especially designed to withstand the action of chemical reagent in the soil.

- d. *Inside Wiring in Wood Frame* should be of armored cable (sometimes specified by trade name such as *BX* cable).

1. Alternate specification is to require nonmetallic sheathed cable (sometimes specified by trade names such as *Romex* or *BraidX*).

2. Alternate specification is to require knob and tube work. (This is not permitted by most city codes and, if used, special type switch and outlet boxes should be specified.)

- e. *Inside Wiring in Masonry or Concrete* should be insulated wire in rigid metal conduit, or alternate specification is to require insulated wire in electric metallic tubing.

- f. *Signalling System Wiring* should be braided rubber insulated wire run open within framing and with all joints soldered and taped.

## 29-3 OVERHEAD SERVICE

- a. It is customary for the local power company to furnish materials and run the overhead electric service drop from the pole to the house except

for the service rack which is generally furnished by the local power company and installed by the Contractor.

- b. *Type of Service* should be noted in the specifications and the local power company should be consulted as to the type available in the locality of

TABLE 29-1. CIRCUITS FOR GENERAL LIGHTING AND SMALL APPLIANCES

<i>Sq. Ft. Fl. Area of House</i>	<i>Lighting 15 amp. Branch Circuits</i>	<i>Appliance 20 amp. Branch Circuits</i>	<i>Total Wattage</i>	<i>Demand Wattage</i>	<i>Demand amps.</i>
1,000	2	1*	4,500	3,525	15.3
1,500	3	2**	7,500	4,575	19.9
2,000	4	2**	9,000	5,100	22.2
2,500	5	2**	10,500	5,625	24.4
3,000	6	3	13,500	6,675	29.0
3,500	7	3	15,000	7,200	31.3
4,000	8	3	16,500	7,725	33.6

\* Assuming no Laundry or Work Shop.

\*\* Assuming no Work Shop.

the job. The type of service in residential areas is generally 3-wire, 115-230 volts, 60-cycle, single-phase. Other types of service are:

2-wire, 115 volts, 60-cycle

2-wire, 220 volts, 60-cycle

3-wire, 120-240 volts, 60-cycle, single-phase

4-wire, 120-208 volts, 60-cycle, three-phase (usually in downtown areas of large cities)

4-wire, 115-230 volts, 60-cycle, three-phase

- c. *Service Conductors* should be specified to terminate on the outside of the house at a point as high as practicable above the ground level.

TABLE 29-2. CIRCUITS FOR FIXED APPLIANCES

<i>Fixed Appliances</i>	<i>Conductor Size</i>	<i>Amp. Circuit</i>	<i>Wattage</i>	<i>Demand Wattage</i>	<i>Demand amps.</i>
Furnace blower and motor	12	20	1,000	1,000*	4.4*
Washing machine	12	20	375	375*	1.6*
Electric range	6	50	11,600	8,000	34.8
	(8 Neutral)				
Water heater	12	20	3,000	3,000*	13.0*
Dishwasher and garbage eliminator	12	20	1,000	1,000*	4.4*
Bath heater	12	20	1,000	1,000*	4.4*
Clothes dryer	10	25	4,500	4,500*	19.6*
Ironer	12	20	1,650	1,650*	7.2*
Spare	—	20	1,000	1,000*	4.4*

\* Where 4 or more fixed appliances, not including range, are used, 75% of these figures may be applied.

1. Alternate specification is to require the point to be approximately 18' 0" above the ground level where streets or driveways occur and 16' 0" above ground level where walks occur.
2. The service conductors are usually specified to consist of 3 wires and the size of these conductors determined and specified.
3. For usual conditions the size of adequate conductors may be determined by adding the *Demand Amperes* from Tables 29-1, 29-2 and 29-3 and then finding the AWG conductor size required for the *Total Demand Amperes* from Table 29-4.

TABLE 29-3. CIRCUITS FOR AIR CONDITIONING UNITS

AC Unit*	Conductor Size	Amp. Circuit	Fused	Demand Amps.
1 Ton (1 phase)	12	30	25	8
2 Ton (1 phase)	12	60	40	12
3 Ton (1 phase)	10	60	60	17
5 Ton (3 phase)	10	60	60	18
7½ Ton (3 phase)	8	100	80	27
10 Ton (3 phase)	8	100	100	32
15 Ton (3 phase)	4	200	165	55
20 Ton (3 phase)	3	200	200	66
<b>Motor</b>				
¾ hp (3 phase)	12	30	10	3
1 hp (3 phase)	12	30	15	4
1½ hp (3 phase)	12	30	15	5
2 hp (3 phase)	12	30	20	7
3 hp (3 phase)	12	30	30	9
5 hp (3 phase)	12	60	45	15

\* Capacities listed include compressor, fan and small auxiliaries. Cooling tower fan and circulating water pumps shall be added, selected from list under "MOTOR" of this table.

d. *Entrance Fittings:* The Contractor should be required to furnish all necessary entrance caps, grounding devices, couplings, connectors and straps required for the service entrance Conductors.

#### 29-4 UNDERGROUND SERVICE

- a. If the service is to be brought from a power pole the first sentence in a paragraph of this title should be similar to 1 below.  
If the service is to be brought from local power company's underground wiring, then the first sentence should be similar to 2 below.
  1. "Contractor's work shall begin on the nearest power pole. Start at a point on pole as required by the local power company. Bring conductors down pole and run them underground from pole to service inside the building."
  2. "Contractors work shall begin from power company's nearest man-

hole. Run conductors underground to entrance equipment inside building."

b. *Type of Service*: See Subparagraph b of Paragraph 29-3 above.

c. *Service Conductors*: For number and size of service conductors, see Subparagraph c of Paragraph 29-3 above.

## 29-5 ELECTRIC METER

The meter for a building is furnished and installed by the local power company. The meter receptacle is usually furnished by the power company, but

TABLE 29-4. SIZE OF SERVICE CONDUCTOR AND MAIN SWITCH  
AND FUSES OR CIRCUIT BREAKER

<i>Demand Amps.</i>	<i>Conductor Size AWG</i>	<i>Switch (amps.)</i>	<i>Fuses (amps.)</i>	<i>Circuit Breaker (amps.)</i>
25	10	30	25	30
35	8	60	35	40
50	6	60	50	50
70	4	100*	70	70*
90	2	100	90	90
100	1	100	100	100
125	1 RH	200	125	125 J
150	1/0 RH	200	150	150 J
175	2/0 RH	200	175	175 J
200	3/0 RH	200	200	200 J
225	4/0 RH	400	225	225 J
250	250 MCM RH	400	250	250 KL
275	300 MCM RH	400	275	275 KL
300	350 MCM RH	400	300	300 KL

\* Recommended minimum size for a residence.

the Contractor is required to install it in accordance with the power company's requirements. The specification writer should stipulate the location of the meter. Power companies usually prefer for the meter to be located on the outside of the building to enable the meter to be read even when the building is unoccupied. The meter is often located on the exterior wall near the kitchen door, basement door or garage door.

## 29-6 SERVICE EQUIPMENT

a. The specification writer should give the location of the service equipment which is usually in a basement or utility area and near the meter location. He should also state whether the equipment is to be surface-mounted or flush-mounted, and whether it is to be a switch with fuses or a breaker; then he should add one of the following sentences:

1. "Main Switch shall be general-purpose single-throw safety switch

(or pull-out type switch) with \_\_\_\_\_ \* ampere rating and fused with \_\_\_\_\_ \* ampere cartridge or knife blade type fuses."

2. "Main Circuit Breaker shall have a grounded neutral and be arranged for service specified and shall have \_\_\_\_\_ \* ampere rating."

b. *Main Distribution Unit* is specified to be fused dead front type (or breaker type) with provision for the following circuits:

- \_\_\_\_\_ Circuits †, 15 amp., for lighting
- \_\_\_\_\_ Circuits †, 20 amp., for appliances
- 1 Circuit, 50 amp., for range
- 1 Circuit, 25 amp., for clothes dryer

## 29-7 BRANCH FEEDERS AND DISTRIBUTION UNITS

For very small houses, it is practical and economical to have the main distribution unit include only 8 of the 15 and 20 amp. circuits and 1 range circuit. When the house requires more circuits than these, it is better practice and more economical to specify that the Contractor may separate the circuits among two or more distribution centers of flush type to be located in areas of the building to be designated by the Architect (or as shown on the drawings). The Contractor should be required to furnish switches (or breakers) at the main distribution center and feeders of the ratings given in Table 29-5 and not less than the sizes indicated.

TABLE 29-5. MINIMUM SIZES OF FEEDERS

Ratings of Fuse for Switches or Breakers (amps.)	Size of Feeder AWG (unless voltage drop requires larger)	Control Center Circuit	
		15 and 20 Amp. Branch Circuits	30 Amp. Branch Circuits
25	10	4	—
25	10	6	—
25	10	8	—
35	8	4	1
35	8	6	1
50	6	8	1

## 29-8 CIRCUITS

It is often specified that the total number of outlets be divided as nearly as possible between the circuits. The outlets of each principal room shall be

\* For determining the ampere rating of the main switch and the ampere rating of the fuses or the ampere rating of the main circuit breaker, Table 29-4 may be used after computing Demand Amperes from Tables 29-1, 29-2 and 29.3.

† The number of circuits required for usual conditions may be determined from Tables 29-1, 29-2 and 29.3 but the individual rating of fixed equipment should be used whenever known.

served by two circuits so that interruption of one circuit will not leave the area in darkness:

1. "*Lighting Circuits:* Outlets for lighting and for convenience receptacles, not otherwise specified, shall be supplied by 15 amp. circuits of No. 12 wire." (Although the National Electric Code permits use of No. 14 wire, it is considered better practice to specify No. 12.)
2. "*Appliance Circuits:* Convenience outlets in Dining Area, Breakfast Area, Kitchen, Laundry, Utility Room and Garage shall be supplied by 20 amp. circuits of No. 12 wire."
3. "*Range Circuit:* Electric range shall be supplied by 50 amp. circuit of No. 6 wire with No. 8 neutral."
4. "*Clothes Dryer Circuit:* Electric clothes dryer shall be supplied by 25 amp. circuit of No. 10 wire."
5. "*Fixed Appliance Circuits:* Each of the following fixed appliances shall be supplied by one 20 amp. circuit of No. 12 wire:

Electric hot water heater

Furnace motor

Attic fan

Washing machine

Dishwasher and garbage eliminator

Bath room heater."

## 29-9 BOXES

It is usually specified that boxes shall be installed for all switches and outlets shown on the drawings and these boxes shall be one or more gang as required for each location. Boxes should be black enameled or galvanized sheet steel. (If knob and tube wiring is used, then the boxes are specified to be porcelain.) If the specification writer wishes to limit the boxes to certain manufacturers, they should be mentioned at this point.

1. "*Switch and Receptacle Boxes* shall be standard sectional switch boxes and shall be installed in frame work on metal mounting brackets.
2. "*Outlet Boxes* shall be standard 3 1/4" octagonal or round and shall be installed in frame work on metal bar hangers.
3. "*Special Boxes* shall be provided for range receptacle and other special wiring devices. Where conduit is run exposed on Basement and Garage walls, boxes and fittings shall be Condulet type."

## 29-10 RECEPTACLES AND WALL SWITCHES

The simplest way to specify the receptacles and wall switches desired is to select those of one manufacturer's brand name and permit the use of outlets and wall switches produced by other manufacturers, provided they are similar to those specified and of equal quality. The outlets and wall switches may be specified only by description.



1. "*Flush Tumbler Type Wall Switches*, except where otherwise specified, shall have Bakelite base and brown (or ivory) handles."
2. "*Flush Mercury-Type Wall Switches* shall be installed (throughout) in Living Room, Dining Room and Entrance Hall. Flush mercury type wall switches shall operate silently and shall have brown (ivory) handles."
3. "*Outdoor Type Switches*: Wall switches on exterior of building shall be waterproof type with rubber mat and cadmium-plated brass plate."
4. "*Automatic Door Switches* should be 'on' when door is open. Furnish with box and plate for mounting in door jamb."
5. "*Switch and Pilot* shall be provided for wall switches controlling Garage Light and Basement Light. Switch and pilot shall be combination for mounting in single-gang box."
6. "*Iron Receptacle* shall consist of switch, pilot light and single convenience outlet combination and polished chromium-plated plate. Both pilot and outlet shall be controlled by switch."
7. "*Convenience Receptacles*, except where otherwise specified, shall be duplex type of brown (ivory) Bakelite."
8. "*Outdoor Convenience Receptacles*: Convenience receptacles on exterior of building shall be duplex (single) waterproof type with automatic closing lids (lid), waterproof material, and brass plate with sprayed aluminum finish."
9. "*Clock Hanger Receptacle* shall be brown (ivory) Bakelite, recessed to provide convenient nesting of clock cord."
10. "*Floor Receptacle* shall be recessed type with brass cover and two brass plugs."
11. "*Range Receptacle* shall be wall type polarized, 50 amp. outlet of Bakelite with brush brass plate and 4" square box; furnish range cord set."
12. "*Clothes Dryer Receptacle* shall be polarized, 20 amp., made of Bakelite."
13. "*Installation*: Outlets and wall switches shall be installed as shown on drawings and wired to provide switch control indicated on the drawings. Wall switches shall be installed 3' 6" (4' 0") above the floor. Convenience receptacles shall be 2" above the baseboard except where receptacles occur over counters and work benches where they shall be located 3' 6" above the floor. Kitchen clock receptacle, 7' 4" above the floor. Bracket outlets 5' 6" above the floor."

#### 29-11 PLUG-IN STRIPS

Plug-in strips are sometimes used around the base of Living Room, along the back of Kitchen Counters and along the base of walls where beds will

be placed in Bed Rooms. When indicated on the drawings they may be specified as follows:

*"Plug-in Strips* shall be installed in baseboards where indicated on drawings. Plug-in strips shall consist of prefabricated metal channel and cover strips with convenience receptacles 18" o.c. Furnish all necessary elbows, junction boxes, end pieces and other fittings required to make a complete and neat installation."

## 29-12 PLATES

It should be stated in the specifications that all outlets shall be provided with single plates of the proper gauge. Brush brass plates 0.060" thick are often specified for commercial work. Enameled steel and mirror plates are sometimes specified for residences, but more often the plates are specified as follows:

1. *"Brown (Ivory) Bakelite Plates* shall be provided for all outlets, not otherwise specified."
2. *"Metal Plates:* Stainless steel plates with satin finish or chromium-plated metal plates shall be provided for all outlets in Kitchen, Laundry and Bath Rooms."

## 29-13 ATTIC FAN

Attic fan is sometimes specified to be furnished and installed by the Electrical Contractor. The fan is usually located as indicated on the drawings and the size is generally selected to move 1 cu. ft. of air per minute (for southern areas of U. S.; 1 cu. ft. per 1½ minute for northern areas) from the areas to be ventilated. The manufacturer, size, type, cfm, free delivery, rpm and hp should be given. Table 29-6 shows the various fans made by one manufacturer.

TABLE 29-6. ATTIC FAN CAPACITIES AND SIZES

<i>Cfm Free Delivery</i>	<i>Rpm</i>	<i>Hp</i>	<i>Overall Size of Crate</i>
4,300	530	$\frac{1}{16}$	33" x 34" x 25"
7,000	448	$\frac{1}{16}$	38" x 39" x 26½"
10,000	338	$\frac{1}{16}$	48" x 49" x 29½"
13,000	258	$\frac{1}{16}$	56" x 57" x 33½"
14,300	284	$\frac{1}{16}$	56" x 57" x 33½"
16,000	326	$\frac{1}{16}$	56" x 57" x 33½"
19,000	266	$\frac{1}{16}$	62" x 63" x 36½"
21,500	298	$\frac{1}{16}$	62" x 63" x 36½"

### 29-14 KITCHEN FAN

The Electrical Contractor is sometimes required to furnish and install Kitchen Fan to exhaust cooking odors. The least expensive type is the wall type requiring no duct work. This type may be specified as follows:

*"Kitchen Fan shall be installed in wall of Kitchen where indicated. Fan shall have a capacity rating of at least 400 cfm free delivery operating at not more than 1565 rpm. Motor shall be 115 volt, 60 cycle, single phase, 60 watt. Fan shall be complete with wall box, metal sleeve, weather door, chain, switch and plastic grille."*

### 29-15 ELECTRIC BATH ROOM HEATERS

Electric bath room heaters are sometimes shown and specified for auxiliary heat in Bath Rooms. These are best specified by giving trade name and manufacturer and designating the wattage, volts, size and type of grille; for example:

*"Electric Bath Room Heaters shall be Built-In type as manufactured by \_\_\_\_\_ Electric Heater Company, 1000 (1250) (1500) watts, 115/120 volts (230/240 volts) for wall opening 8 $\frac{3}{8}$ " wide, 17 $\frac{1}{2}$ " high, 3 $\frac{7}{8}$ " deep. Heater shall have chromium-plated metal grille."*

### 29-16 CONNECTIONS TO EQUIPMENT

- a. It should be noted in the specifications that the Electrical Contractor shall make the electrical connections to all equipment requiring electrical current.
- b. *Equipment to be Furnished by the Owner* (sometimes by the Electrical Contractor) and installed and connected by the Electrical Contractor includes the following:

Range	Clothes dryer
Refrigerator	Ironer
Home freezer	

- c. *Equipment Furnished and Installed* under other sections of the specifications, but electrically connected by the Electrical Contractor, includes the following:

Furnace motor	Garbage eliminator
Dishwasher	Electric domestic hot water heater
Washing machine	Air conditioning equipment

### 29-17 SIGNALLING SYSTEM

In many residences a signalling system is installed and fundamental specification for the system is as follows: (The specification writer might add the manufacturer's catalog numbers.)

1. "*Bells, Buzzers and Chimes:* Install in Kitchen one bell, one buzzer and one duo-chime."
2. "*Push Buttons:* Install push button at front and one at service door and connect to duo-chimes. Install one push button in Master Bed Room and connect to bell."
3. "*Floor Push:* In the center of dining room install an outlet with 6' 0" cord and floor push for signal to Kitchen at meal time. Connect floor push through outlet to buzzer in Kitchen."
4. "*Transformer and Wire:* Install near main distribution center a transformer to serve the signalling system. No. 18 gauge wire shall be used for signalling system."

### 29-18 TELEPHONE SERVICE

A complete conduit system for the installation of telephone service in a residence is ideal, but more often provision is made only for the service entrance and the telephone outlets. The wiring, plugs and telephones are installed by the local telephone company. The specification for telephone service may read as follows, if service is overhead:

- a. *Service Entrance:* Provide a weatherhead 2 ft. below power inlet and run  $\frac{3}{4}$ " electric metallic tubing to the basement, making bends as long and sweeping as possible.
- b. *Outlets:* Where telephone outlets are indicated in the drawings, install electric switch box at least  $2\frac{1}{2}$ " deep. Extend  $\frac{1}{2}$ " electric metallic tubing to Basement. Install on each box a single hole cover.

### 29-19 LAMPHOLDERS

Although the electrical fixtures are usually purchased under an allowance, it is customary to have the Electrical Contractor furnish and install the lampholders. The specification for this may read as follows:

"*Lampholders:* Provide porcelain type lampholders with shadeholder grooves for all outlets indicated in Closets, Attic spaces, Basement Areas and Garage. All lampholders except those in closets shall have convenience outlets. Receptacles shall have pull chains and cord, except those indicated to be controlled by switches which may be keyless type."

## 29-20 LIGHTING FIXTURES

The Owner usually wishes to participate in the selection of lighting fixtures, and, to provide for this, the Architect usually sets up an allowance for the purchase of these fixtures. Therefore, the *Electrical* section of the specifications includes a paragraph similar to the following:

*"Lighting Fixtures:* Install lighting fixtures and allow the sum of \$ \_\_\_\_\_ for their purchase."

### AUTHOR'S NOTE

Without extensive experience in construction work, the great frustration in specification writing can be the marshalling of sufficient facts and exact details to state simply and logically the qualifications to be met by the various building trades for a job.

In the foregoing chapters, a few detailed examples for an entire building operation have been arranged and presented with the hope that they may serve, not as rules, but as suggestions and a guide for the reader.

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